(13)

TRANSCRIPT OF RECORD

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, [redacted] 1926

No. [redacted] 154

OKLAHOMA NATURAL GAS COMPANY, PLAINTIFF IN ERROR,

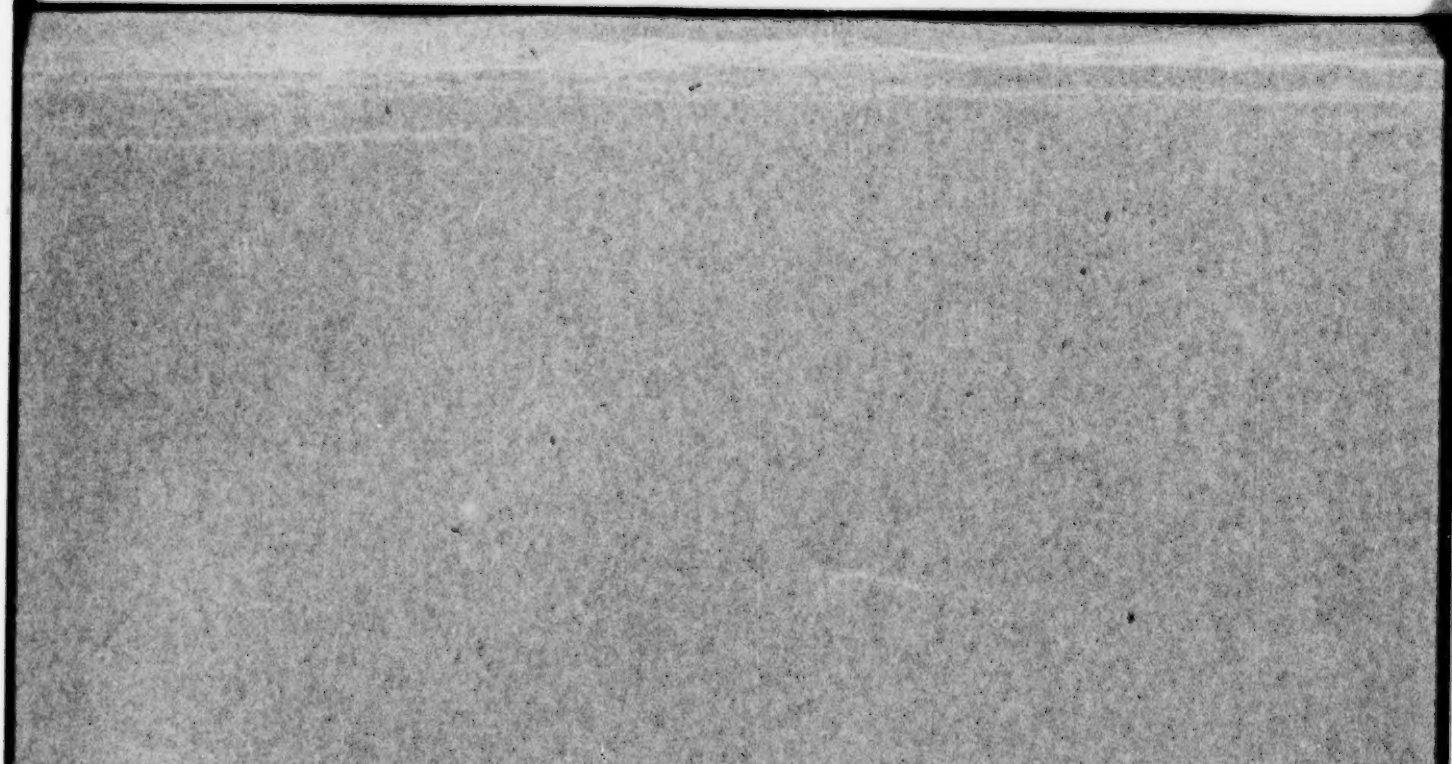
vs.

THE STATE OF OKLAHOMA

IN ERROR TO THE SUPREME COURT OF THE STATE OF OKLAHOMA

FILED JUNE 28, 1926

(31,266)



(31.288)

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1925

No. 565

OKLAHOMA NATURAL GAS COMPANY, PLAINTIFF IN ERROR,

vs.

THE STATE OF OKLAHOMA.

IN ERROR TO THE SUPREME COURT OF THE STATE OF OKLAHOMA

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[fols. a-c] **IN SUPREME COURT OF OKLAHOMA**

RETURN TO WRIT OF ERROR

In response to the within Writ of Error, I herewith transmit a certified transcript of the record and all proceedings had in the Supreme Court of Oklahoma in case No. 11511, Oklahoma Natural Gas Company, a corporation, et al., versus The State of Oklahoma,

In witness whereof, I hereto set my hand and affix the seal of said Supreme Court, at Oklahoma City, Oklahoma, this 13th day of June, 1925.

Wm. M. Franklin, Clerk Supreme Court Oklahoma, by Jessie Pardee, Deputy. (Seal of the Supreme Court, State of Oklahoma.)

[fols. 1 & 2] CITATION—In usual form, showing service on George F. Short et al.; filed June 4, 1925, omitted in printing.

[fol. a] [File endorsement omitted]

IN SUPREME COURT OF OKLAHOMA

No. 11511

OKLAHOMA NATURAL GAS COMPANY, Appellant,

vs.

THE STATE OF OKLAHOMA, Appellee.

PETITION FOR WRIT OF ERROR—Filed June 4, 1925

Oklahoma Natural Gas Company, appellant in the cause above entitled and numbered, feeling itself aggrieved by the decision and judgment of this court rendered in said cause of June 2, 1925, comes now by Ames, Lowe, Richardson & Cochran, its attorneys of record herein, and petitions the court for an order allowing this appellant to prosecute a writ of error to the Supreme Court of the United States under and according to the constitution and laws of the United States and the rules of said court in that behalf made and provided, and for an order that all further proceedings herein be suspended and stayed until the determination of said writ of error by the Supreme Court of the United States, and your petitioner will ever pray.

Ames, Lowe, Richardson & Cochran, Attorneys for Appellant.

[fol. 4] [File endorsement omitted]

IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ASSIGNMENTS OF ERROR—Filed June 4, 1927

Now comes Oklahoma Natural Gas Company, a corporation, appellant in the cause above entitled, and says that in the record and proceedings in said cause there is manifest error in this, to-wit:

1

The Supreme Court of the State of Oklahoma erred in affirming the order of the Corporation Commission of the State of Oklahoma appealed from.

2

The Supreme Court of the State of Oklahoma erred in deciding, holding and adjudging that the order of the Corporation Commission of the State of Oklahoma appealed from does not deprive appellant of its property without due process of law in violation of the Fourteenth Amendment to the Constitution of the United States.

[fol. 5] 3

The Supreme Court of the State of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that the said order of the Corporation Commission of Oklahoma appealed from operates to take appellant's private property for private use without just compensation, in violation of the Fourteenth Amendment to the Constitution of the United States.

4

The Supreme Court of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that the said order of the Corporation Commission of the State of Oklahoma appealed from operates to take appellant's private property for public use without just compensation, in violation of the Fourteenth Amendment to the Constitution of the United States.

5

The Supreme Court of the State of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that the said order of the Corporation Commission of the State of Oklahoma appealed from operates to deny appellant the equal protection of the law, in violation of the Fourteenth Amendment to the Constitution of the United States.

6

The Supreme Court of the State of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that the said order of the Corporation Commission of the State of Oklahoma is arbitrary and capricious, and is based upon no complaint, pleading or prayer filed with said corporation commission by any person, and upon no evidence given before said commission in any manner [fol. 6] sustaining or tending to sustain said order, and that for said reasons the said order of the Corporation Commission of Oklahoma operates to deprive appellant of its property without due process of law, and to deny it the equal protection of the law, both in violation of the Fourteenth Amendment to the Constitution of the United States.

7

The Supreme Court of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that said order of the Corporation Commission of Oklahoma is arbitrary and capricious in that it does not grant rebates or discounts only to those consumers in Oklahoma City whose bills were incurred during the period of shortage, but it grants the same percentage of rebate to every patron in each district, even though during the low pressure period such patrons were using other fuel, and even though their entire bills for gas were incurred during that portion of the month when the pressure was normal, and the Supreme Court of Oklahoma erred in failing and refusing to hold that said order thereby operates to deprive appellant of its property without due process of law and to deny it the equal protection of the law, in violation of the 14th Amendment to the Constitution of the United States.

8

The Supreme Court of Oklahoma erred in failing and refusing to hold that said order of the Corporation Commission of Oklahoma operated to deprive appellant of its property without due process of law and to deny it the equal protection of law, both in violation of the Fourteenth Amendment to the Constitution of the United States, for the reason that said order is not supported by a scintilla of evidence, but is purely arbitrary and wholly baseless.

[fol. 7]

9

The Supreme Court of Oklahoma erred in failing and refusing to hold that the standard of pressure adopted by the Corporation Commission of Oklahoma in said order bears no reasonable or proportionate relation to the character of service prescribed and no reasonable relation to the amounts of discounts or rebates required, but is purely arbitrary and is impossible to be complied with, and therefore violates the Fourteenth Amendment to the Constitution of the United States.

10

The Supreme Court of Oklahoma erred in failing and refusing to hold and adjudge that said order of the Corporation Commission of Oklahoma appealed from operates to deprive appellant of its property without due process of law and to deny it the equal protection of the law, both in violation of the Fourteenth Amendment to the Constitution of the United States in that said order grants discounts, refunds or rebates to hundreds of consumers whose entire bills were incurred when gas was at normal pressure.

11

The Supreme Court of the State of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that said order of the Corporation Commission of Oklahoma operates to deprive appellant of its property without due process of law, and to deny it the equal protection of law, both in violation of the Fourteenth Amendment to the Constitution of the United States, in that said order permits consumers to burn appellant's gas twenty-four hours a day when the pressure is less than one ounce, and yet denies appellant any compensation whatsoever for the gas so burned.

[fol. 8]

12

The Supreme Court of Oklahoma erred in failing and refusing to hold and adjudge, as prayed by appellant, that said order of the Corporation Commission of Oklahoma appealed from operates to deprive appellant of its property without due process of law, and to deny it the equal protection of the law, both in violation of the Fourteenth Amendment to the Constitution of the United States, in that said order undertakes to impose upon appellant, the basis of whose service is an exhaustible commodity which man cannot make, absolute obligation to furnish an adequate quantity at all times, under all circumstances, and at all events, notwithstanding it was humanly impossible to do so, and notwithstanding appellant was doing and had been doing everything in its power to furnish the full amount demanded and desired, and notwithstanding appellant was not making an adequate return even at the established rates before paying any discounts or rebates.

Wherefore appellant prays that the judgment of the Supreme Court of the State of Oklahoma affirming the said order of the Corporation Commission of Oklahoma shall be reversed, vacated and annulled, and that said Supreme Court of Oklahoma shall be ordered and directed to reverse and annul the said order of the Corporation Commission of Oklahoma.

Amos, Lowe, Richardson & Cochran, Attorneys for Appellant.

[fol. 9] [File endorsement omitted]

Copy

IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ORDER ALLOWING WRIT OF ERROR—Filed June 4, 1925

This cause coming on to be heard on the 4th day of June, 1925, upon petition of the appellant for a writ of error herein to the Supreme Court of the United States, and it appearing that the appellant has filed its assignments of error, it is hereby ordered upon motion of David A. Richardson, one of the attorneys for appellant, that a writ of error be and it is hereby allowed to have reviewed in the Supreme Court of the United States the judgment rendered in said cause by this court on June 2, 1925, affirming the order of the Corporation Commission of the State of Oklahoma in said appeal complained of.

And it further appearing that said appellant has prayed for an order suspending, superseding and staying the enforcement of said order of the corporation commission until the determination of said writ of error by the Supreme Court of the United States, it is further ordered that said appellant be required to execute its bond in said cause in the sum of $40,000.00, and that upon the filing of said [fol. 10] bond and its approval by the Chief Justice of this Court, it is ordered that all further proceedings be suspended and stayed until the determination of said writ of error by the Supreme Court of the United States.

Ordered, adjudged and decreed this 4th day of June, 1925.

Geo. M. Nicholson, Chief Justice of the Supreme Court of Oklahoma.

Attest: Wm. M. Franklin, Clerk of the Supreme Court of the State of Oklahoma. by Jessie Pardue, Deputy. (Seal.)

[fol. 11] [File endorsement omitted]

IN SUPREME COURT OF OKLAHOMA

[Title omitted]

WRIT OF ERROR—Filed June 4, 1925

The President of the United States to the honorable justices of the Supreme Court of the State of Oklahoma, Greeting:

Because, in the record and proceedings, as also in the rendition of the judgment, in the cause which is in said court before you or some of you between the parties above named, viz: Oklahoma

Natural Gas Company, a corporation, Appellant, and The State of Oklahoma, Appellee, numbered 11,511 on the docket of the Supreme Court of Oklahoma, your court being the highest court of said state having jurisdiction to render judgment in the case, there was drawn in question the validity of a statute of, and an order of, and an authority exercised under, said state, on the ground of their being repugnant to the Constitution of the United States, and the decision was in favor of their validity, and there being manifest error in said decision greatly to the damage of the Oklahoma Natural Gas [fol. 12] Company, a corporation, Appellant, and we being willing that if there is error, it should be duly corrected, we do therefore command you, if judgment be therein given, that under the seal of your court you send the record and proceedings had in said cause to the Supreme Court of the United States together with this writ, so that you have the same in the City of Washington in the District of Columbia on the 4th day of July, 1925, in the Supreme Court to be then and there held, that the record may be inspected by said court and justice done.

Witness the Honorable William H. Taft, Chief Justice of the Supreme Court, the 8th day of June, 1925.

Harry L. Finley, Clerk of the District Court of the United States for the Western District of Oklahoma. (Seal of the United States District Court, Western District of Oklahoma.)

Allowed: Geo. M. Nicholson, Chief Justice of the Supreme Court of Oklahoma.

Attest: Wm. M. Franklin, Clerk of the Supreme Court of Oklahoma, by Jesse Parlee, Deputy. (Seal of Supreme Court, State of Oklahoma.)

[fols. 13-15] Supersedeas Bond on Writ of Error for $40,000.00. Approved and filed June 11, 1925; omitted in printing.

[fol. 16] [File endorsement omitted]

In Supreme Court of Oklahoma

[Title omitted]

Praecipe for Transcript of Record. Filed June 4, 1925.

To the Clerk of the Supreme Court of Oklahoma:

The appellant, Oklahoma Natural Gas Company, having prayed and obtained a writ of error to the Supreme Court of the United States in the cause above entitled and numbered, hereby requests that you prepare a full and complete transcript of the record of the

proceedings in said cause in the Supreme Court of Oklahoma for transmission to and filing in the Supreme Court of the United States; and the appellant, considering that the entire record in this cause is necessary to a full and complete understanding thereof by the Supreme Court of the United States, requests that no portion of the record in the Supreme Court of Oklahoma be eliminated, but that all of the same be incorporated in said transcript.

Ames, Lowe, Richardson & Cochran, Attorneys for Appellant.

[fol. 17] [File endorsement omitted]

IN SUPREME COURT OF OKLAHOMA

[Title omitted]

PETITION—Filed June 15, 1920

Comes now the Oklahoma Natural Gas Company, plaintiff in error, and complaining of the action of the Corporation Commission of Oklahoma says:

That on January 10, 1920, said Corporation Commission, in the above entitled and numbered cause promulgated a proposed order, in which it required that plaintiff in error, the Oklahoma Natural Gas Company, and its agent the Oklahoma Gas & Electric Company, should discount and rebate the bills for natural gas furnished to its consumers in the City of Oklahoma City during the months of November and December, 1919, in certain sums in said proposed order stated, or else should appear before said Commission on January 26, 1920, and then and there show cause why the same should not be done.

[fol. 18] Thereafter, on said January 26, 1920, this plaintiff in error, Oklahoma Natural Gas Company, duly appeared before said Corporation Commission and filed its response to said order to show cause, and produced before said Commission evidence in support of its said response, and thereupon at the conclusion of said evidence said Corporation Commission took said matter under advisement.

On June 7, 1920, said Corporation Commission made and entered its order in said cause No. 3846, which order is numbered 1649, overruling the protest and objection of this plaintiff in error to said proposed order requiring said rebates, adjudging the response and evidence introduced in support thereof insufficient, and ordering that said rebates, discounts and deductions from said bills for natural gas incurred during the months of November and December, 1919, should be made, from which said order this plaintiff in error has appealed.

And this plaintiff in error says and avers that there is substantial error in said proceeding prejudicial to it, in the following particulars, to-wit:

1. The said action and order of said Commission is contrary to the evidence.

2. The said action and order of said Commission is contrary to the law.

3. The said action and order of said Commission is contrary to the law and the evidence.

4. The said action and order of said Commission is violative of Section 7 of Article 2 of the Constitution of the State of Oklahoma, in that the same deprives this plaintiff in error of property without due process of law.

5. The said action and order of said Commission is violative of Section 23 of Article 2 of the Constitution of the State of Oklahoma, in that the same operates to take private property for private use [fols. 19-21] without just compensation.

6. The said action and order of said Commission is violative of Section 24, of Article 2, of the Constitution of the State of Oklahoma, in that the same operates to take private property for public use without just compensation.

7. The said action and order of said Commission is violative of the Fourteenth Amendment to the Constitution of the United States the protection of which this plaintiff in error specifically claims, in that said action and order of said Commission operates to deprive this plaintiff in error of its property without due process of law, and denies to this plaintiff in error the equal protection of the law.

A true, correct and certified transcript of the proceedings had before said Corporation Commission in said cause, and a true, correct and complete case-made showing all of said proceedings and orders and disclosing the errors hereinbefore complained of, is hereto attached and made a part hereof.

Wherefore, the premises considered, plaintiff in error prays that this honorable court will reverse the said action of said Corporation Commission and will remand the same to said Commission, with directions to vacate its said order therein made, and to dismiss said proceeding.

Ames, Chambers, Lowe & Richardson, Attorneys for Plaintiffs in Error.

[fol. 22] [Caption omitted]

[fol. 23] BEFORE CORPORATION COMMISSION OF OKLAHOMA

Cause No. 3846

In the Matter of Interpreting the Charts and Determining Discounts on Bills for Gas Furnished by the OKLAHOMA GAS & ELECTRIC COMPANY and the OKLAHOMA NATURAL GAS COMPANY in Oklahoma City in Accordance with Commission's Orders No. 1374 and 1599 and Journal Entry, Cause No. 3846.

FINDINGS OF FACT AND ORDER OF COMMISSION—Jan. 10, 1920

On February 9, 1918, the Commission issued its order No. 1374, cause No. 3223, in which it outlined the general policy of the Commission in dealing with charges for inadequate gas service as follows:

"The testimony before the Commission would indicate that under ordinary conditions a reasonable amount of service can be secured from gas with a four ounce pressure or better; and the Commission will hold that four ounces is the minimum pressure that a company distributing gas may furnish in order to give reasonable service; that a three ounce pressure provides only 75% reasonable service; a two ounce pressure only 50 per cent reasonable service; and a one ounce pressure only 25 per cent reasonable service, for the length of time that each such pressure is maintained. Less than one ounce pressure will not be recognized by the Commission as service at all or as being of any value to the consumer.

"The average consumer uses gas about 16 hours per day, or from 6:00 A. M. to about 10:00 P. M., and it is generally during these hours that the pressure is low and that service is poor. Pressure during these hours should never be allowed to run below four ounces.

"The Commission further holds that an equitable distribution of the losses arising from poor and inadequate service, as between the gas company and a consumer, could be arrived at by discounting the bills for service rendered each month upon the basis heretofore indicated, i. e. that no charges should be made for any time when the gas pressure is below one ounce; that one ounce pressure should be charged for at 25 per cent of the schedule rate; two ounce pressure at from 50 per cent of the schedule rate, and three ounce pressure at 75 per cent of the schedule rate, four ounces pressure or above to be accepted as reasonable service.

"The gas company filed at the hearing, pressure gauge chart showing the gas pressure at Nowata for each hour during the months [fol. 24] of December, 1917 and January, 1918. These charts are presumed to be correct.

"This pressure gauge record shows that during the month of December 1917, there were forty-eight hours of three ounce pressure, forty-five hours of two ounce pressure and sixty-four hours of one ounce pressure, or that the company under the rule above laid down,

should not be allowed to collect for periods of twelve hours, twenty-two and one-half hours, and forty-eight hours, respectively, or a total of eighty-two and one-half hours for the month of December 1917. There should be, therefore, a deduction of eighty-two and one-half hours from 496 hours of service normally required during the 31 days of December, or 16 per cent. The pressure gauge records for the month of January 1918, show 61 hours of three ounce pressure, 81 hours of two ounce pressure and 38 hours of one ounce pressure or, under the rule laid down, a failure to give service for a period of 87½ hours. The domestic consumers at Nowata are therefore entitled to a discount on bills rendered for the month of December 1917, of 16 per cent and on bills rendered for the month of January, 1918, of 17½ per cent.

"Wherefore, the premises considered and the Commission being advised, it is therefore ordered that the Nowata County Gas Company shall discount all bills for gas furnished to domestic consumers of the City of Nowata for the month of December, 1917, 16 per cent, and all bills rendered for the month of January 1918, 17½ per cent. The penalty of 10 per cent provided by the rules of the company for the bills not paid within ten days from the date of bill shall not begin to run until after February 18, 1918, or ten days after date of this order."

On the 6th day of November 1919, the Commission in cause No. 1615, issued its order No. 1500 in which it required all gas distributing companies distributing gas in the state of Oklahoma to install recording pressure gauges at all regulator stations and at such other points on their low pressure systems as would record the pressure of gas furnished to their respective consumers. This order is as follows:

"The commission finds that an order embodying the substance of its Proposed Order No. 104 is necessary in order that the Commission be properly informed of the nature and efficiency of the service furnished to the public by individuals, Corporations, Associations, Companies etc. engaged in the business of supplying natural or artificial gas to the public.

It is therefore ordered that: (1) All distributing companies shall keep recording pressure gauges at the point or points where gas is [illegible] received from pipe lines or furnishing companies showing the pressure of gas received at the distributing system.

(2) All distributing companies shall keep recording pressure gauges at each and every regulator station on the low pressure side thereof, and at such other points as may be necessary to record the pressure of gas furnished to consumers in any section not reflected with records necessary by pressure gauges at regulator stations.

(3) It is further ordered that such recording pressure gauges shall be of standard and satisfactory make, being such as will clearly record the variations in pressure, and shall be kept in good repair and properly adjusted.

"It is further ordered that whenever the gas pressure shall register less than four (4) ounces at any recording gauge, the Company in charge thereof, shall, so long as such gas shortage shall continue, make daily reports to the Corporation Commission showing the pressure maintained during the preceding twenty-four (24) hour period at such station recording pressure below four (4) ounces."

On the 13th day of December, 1919, pursuant to and in furtherance of the above orders, the Commission caused a Journal Entry to be issued, which provided as follows, to-wit:

"All distributors of natural gas to domestic consumers in the state of Oklahoma are hereby notified to deduct from the gas bill of each domestic consumer for such low pressure in accordance with Commission's order No. 1374.

"All gas distributors are further notified not to discontinue service to any consumer for failure to pay any gas bill which does not make proper reduction for insufficient service as provided in said order as follows, to-wit:

1. During the time when pressure is below four ounces and not below three ounces to be considered as 75 per cent service.

2. During the time when pressure is below three ounces and not below two ounces to be considered as 50 per cent service.

3. During the time when pressure is below two ounces and not below one ounce to be considered as 25 per cent service.

4. During the time when pressure is below one ounce to be considered as no service.

"The pressure as hereinabove referred to shall be determined by the nearest recording pressure gauge to consumer's meter."

Thereafter on or about the 7th day of January 1920 the Oklahoma Gas & Electric Company by its attorneys appeared before the 1561 26 Commission and submitted charts showing records of gas pressure at which gas had been furnished by the Oklahoma Gas & Electric Company to its consumers in the city of Oklahoma City since October 20, 1919, and asking the Commission to investigate and determine discounts on bills for gas furnished by said company in Oklahoma City, properly allocable during periods of low pressure as prescribed by the orders and journal entry herein above referred to.

Pursuant to the above request, calculations and studies having been made of the charts and other data furnished the Commission, by the company and the Commission's engineering department, the Commission finds:

First. That in the portion of the city east of the Santa Fe Railroad and north of the Rock Island Railroad, which the company designated as District No. 1, the meters are read on the average of the 25th day of each month.

(a) That the proper discount applying to bills in this district for gas used from approximate dates October 25th to November 25, 1919, in two (2) per cent.

(b) That the proper discount applying to bills for gas used from approximate dates November 25 to December 25, 1919, in the portion of this district west of High Street is fifteen (15) per cent.

(c) That the proper discount applying to bills for gas used from approximate dates November 25 to December 25, 1919, in the portion of this district east of High Street is twenty-eight (28) per cent.

Second. That in the portion of the city west of the Santa Fe Railroad (fol. 27) road, and north of 7th street from the Santa Fe Railroad to Pennsylvania Avenue, east of Pennsylvania Avenue from 7th Street to 10th Street and north of 10th Street west from Pennsylvania Avenue, which the company designates as District No. 2, the meters are read on the average of the third day of each month.

(a) That in the portion of this district bounded by Francis Avenue on the east, 21st Street on the south, Pennsylvania Avenue on the west and 36th Street on the north, the proper discount applying to bills for gas used from approximate dates November 3rd to December 3, 1919, is one (1) per cent.

(b) That in the portion of this district bounded by the Santa Fe Railroad on the east, 7th Street from Santa Fe Railroad to Walker Avenue and 12th Street from Walker Avenue to Dewey Avenue on the south, Walker Avenue from 7th Street to 12th Street and Dewey Avenue from 12th Street to 21st Street on the west, and 21st Street on the north, the proper discount applying to bills gas used from approximate dates November 3rd to December 3, 1919, is seven (7) per cent.

(c) That in the portion of this district bounded by Dewey Avenue on the east, 12th Street on the south, McKinley Avenue on the west and 21st Street on the north, the proper discount applying to bills for gas used from approximate dates November 3rd to December 3, 1919, is eight (8) per cent.

(d) That in the portion of this district bounded by Walker Avenue on the east, 7th Street on the south, McKinley Avenue on the west (fol. 28) and 12th Street on the north, the proper discount applying to bills for gas used from approximate dates November 2nd to December 3, 1919, is five (5) per cent.

(e) That in the portion of this district bounded on the east by McKinley Avenue, on the south by 7th Street, on the west by Kentucky Avenue and on the north by 21st Street, the proper discount applying to bills for gas used from approximate dates November 3rd to December 3, 1919, is four (4) per cent.

(f) That in all other portions of this district there is no discount applying to bills for gas used from approximate dates November 3rd to December 3, 1919.

Third. That in the portion of the city lying west of the Santa Fe Railroad on the east, north of the alley between 2nd and 3rd Streets on the south, east of Pennsylvania Avenue on the west and south of 7th Street on the north, which the company designates as district No. 3, North, the meters are read on the average date of the 12th day of each month.

(a) That in the portion of this district east of Dewey Avenue the proper discount applying to bills for gas used from approximate dates November 12th to December 12, 1919, is eleven (11) per cent.

(b) That in the portion of this district west of Dewey Avenue, the proper discount applying to bills for gas used from approximate dates November 12th to December 12th, 1919, is five (5) per cent.

[fol 29] Fourth. That in the portion of the city bounded on the east by the Santa Fe Railroad from the Alley between Second and Third Streets to the Rock Island Railroad and Byers Avenue from the Rock Island Railroad to California Avenue, on the south by California Avenue, on the west by Pennsylvania Avenue and on the north by the alley between Second and Third Street from Pennsylvania Avenue to the Santa Fe Railroad and the Rock Island Railroad. From the Santa Fe Railroad to Byers Avenue, which the company designates as District No. 4, and in which the meters are read on the average of the 20th day of each month.

(a) That in the portion of this district east of the Santa Fe Railroad, the proper discount applying to bills for gas used from approximate dates November 20th to December 20, 1919, is two (2) per cent.

(b) That in the portion of this district between the Santa Fe Railroad and Robinson Avenue, the proper discount applying to bills for gas used from approximate dates November 20th to December 20, 1919, is thirteen (13) per cent.

(c) That in the portion of this district between Robinson Avenue and Shartel Avenue, the proper discount applying to bills for gas used from approximate date November 20th to December 20, 1919, is twenty five (25) per cent.

(d) That in the portion of this district between Shartel Avenue and Western Avenue, the proper discount applying to bills for gas used from approximate dates November 20th to December 20, 1919, [fol 30] is twenty (20) per cent.

(e) That in the portion of this district lying west of Western Avenue, the proper discount applying to bills for gas used from approximate dates November 20th to December 20, 1919, is fifteen (15) per cent.

Fifth. That in the portion of the city lying south of California Avenue from Pennsylvania to Byers Avenue, and south of the Rock Island right-of-way from Byers Avenue, east, which the company

designates as District No. 3, South, the meters are read on the average of the 12th day of each month.

(a) That in the portion of this district south of California Avenue from the river on the east to Dewey Avenue on the west, east of Dewey from California Avenue to Ash Avenue, north of Ash Avenue from Dewey Avenue to the first intersection of the river west of Santa Fe Avenue and north of the river, the proper discount applying to bills for gas used from approximate dates November 12 to December 12, 1919, is fifteen (15) per cent.

(b) That in the portion of this district lying west of Dewey Avenue from California Avenue to the river north of the river from Dewey Avenue to a point midway between Western and Pennsylvania Avenues, east of a north and south line through this point to California Avenue and south of California Avenue from this line to Dewey Avenue, the proper discount applying to bills for gas used from approximate dates November 12th to December 12, 1919 is (fol. 31) three (3) per cent.

(c) That in the portion of this district lying east of Western Avenue and south of the south boundary lines of the two above portions of the district named, the proper discount applying to bills for gas used from approximate dates November 12th to December 12, 1919, is twelve (12) per cent.

(d) That in the remaining portion of this district lying west of Western Avenue, south of the river from Western Avenue to a point midway between Western and Pennsylvania Avenues west of a north and south line from this point to California Avenue, south of California Avenue from this line, there is no discount on bills for gas used from approximate dates November 12th to December 12, 1919.

Wherefore, premises considered and the Commission being fully advised, it is therefore ordered:

First. That the Oklahoma Gas & Electric Company discount its bills for gas supplied to domestic consumers in Oklahoma City in accordance and compliance with the Commission's findings Nos. one to five inclusive in this order.

Second. That any readjustment made necessary by this order between the Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company shall be made in compliance with the contract now existing between the said companies.

Third. The Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company are hereby ordered to immediately perform and fully comply with the terms of this order in making the reductions herein required, or to appear before this Commission at its hearing room at the Capitol building, Oklahoma City, Oklahoma, on the 29th day of January 1920 and show cause, if any they have,

[fols 32 & 33] why they should not be required to carry out the terms of this order.

Done at Oklahoma City, this the 10th day of January, 1920.

Corporation Commission of Oklahoma. ——————, Chairman. Campbell Russell, Commissioner. R. E. Echols, Commissioner.

Attest: J. F. Scott, Secretary.

[fol 34] Before Corporation Commission of Oklahoma

[Title omitted]

Answer—Filed Jan. 23, 1920

Now comes the Oklahoma Natural Gas Company, a corporation, one of the respondents herein, and for its response to the order of the Commission made on January 10, 1920, requiring it to show cause why the bills for natural gas furnished in the City of Oklahoma City through the Oklahoma Gas & Electric Company as a distributing agent during the months of November and December, 1919, should not be discounted or rebated in the percentage mentioned and specified in said order, says:

1. That the gas furnished and distributed in the City of Oklahoma City is the property of this respondent, who buys a portion thereof and produces the remainder thereof, and transports the same to said city, where it is distributed by the Oklahoma Gas & Electric Company as an agent of this respondent under a contract by which the said Oklahoma Gas & Electric Company receives a certain percentage of the collections made from the sale of said gas for its said service as such agent. That this defendant is engaged in the public business of supplying gas in Oklahoma City and in other cities and the rates for gas so supplied have heretofore been fixed by the Commission.

2. That the order for a discount or rebate of the bill for gas during said months of November and December, 1919, is void and of no effect, for the following reasons:

[fol 35] Section 10, Article 9, of the Constitution of Oklahoma provides as follows:

"Before the Commission shall prescribe or fix any rate, charge or classification of traffic, and before it shall make any order, rule, regulation, or requirement directed against any one or more companies by name, the company or companies to be affected by such rate, charge, classification, order, rule, regulation or requirement, shall first be given by the Commission at least ten days' notice of the time and place when and where the contemplated action in the

premises will be considered and disposed of, and shall be afforded a reasonable opportunity to introduce evidence and to be heard thereon, to the end that justice may be done, and shall have process to enforce the attendance of witnesses; and before said Commission shall make or prescribe any general order, rule, regulation or requirement not directed against any specific company or companies by name, the contemplated general order, rule, regulation, or requirement shall first be published in substance, not less than once a week for four consecutive weeks, in one or more of the newspapers of general circulation published in the county in which the Capital of this State may be located, together with the notice of the time and place when and where the Commission will hear any objections which may be urged by any person interested, against the proposed order, rule, regulation, or requirement; and every such general order, rule, regulation, or requirement, made by the Commission shall be published at length, for the time and in the manner above specified, before it shall go into effect, and shall also, so long as it remains in force, be published in each subsequent annual report of the Commission."

Said order of January 10, 1920, purports to be based upon Order No. 1374, Cause No. 3223, made on February 9, 1918, and upon Order No. 1560, Cause No. 3615, made on November 6, 1919, and upon a journal entry, in effect a general order, made by the Commission on December 13, 1919.

That said Order No. 1374, made in Cause No. 3223, was an order directed against the Nowata County Gas Company by name, in a proceeding brought before this Commission by the City of Nowata against said Nowata County Gas Company, in which service of process was had upon said Nowata County Gas Company, and in which a hearing was had and testimony taken, not as to conditions prevailing over the State of Oklahoma, but merely with respect to the conditions prevailing in the City of Nowata, and with respect to the conditions prevailing at said time. And said Order No. 1374 was a temporary order directed against said Nowata County Gas [fol. 36] Company, only, and not against the Oklahoma Gas & Electric Company, and not against the Oklahoma Natural Gas Company, and neither of said companies were served with notice thereof, and neither appeared or were heard thereon. Said order can not therefore, either in whole or in part, be the basis of the order made by this Commission on January 10, 1920.

This respondent further shows that the Commission's Order No. 1560, Cause No. 3615, in which it required all gas-distributing companies distributing gas in the State of Oklahoma to install recording pressure gauges at all regulator stations, while purporting on its face to be a general order, rule and regulation, not directed against any specific company or companies by name, nevertheless was not published in substance once a week for four consecutive weeks in one or more of the newspapers of general circulation published in the city in which the Capitol of the State is located, together with a notice of the time and place when and where the Com-

mission would hear such objections as might be urged by any person or company interested against said order; but on the contrary, said order was not published in its substance at all, and no notice of any time or place when or where said Commission would hear objections to said proposed order was given to this respondent, or to the Oklahoma Gas & Electric Company, or to anyone else; but said order was promulgated, and was purported to be put in force by this Commission, without any hearing or opportunity for a hearing, and without any notice of any kind or character.

This respondent further shows that the said order of this Commission dated January 10, 1920, is merely a statement of the percentage of the discount or rebate required by this Commission to [fol. 37] be made upon the bills for gas in the various districts in Oklahoma City, and is based specifically upon the journal entry of this Commission dated December 13, 1919, which requires all distributors of natural gas to domestic consumers to discount or rebate the bills for gas for low pressure in accordance with the Commission's Order No. 1374, above mentioned, and that said Journal Entry dated December 13, 1919, is in effect a general order directed to no company by name, but specifically requiring the deduction, rebate or discount of all gas bills for low pressure, and said order of January 10, 1920, only prescribed the percentage of discount applying under said Order of December 13, 1919, and that said order of December 13, 1919, is void for the reason that it is a general order, and that the substance of the same was not published once a week for four consecutive weeks, or published at all, in one or more newspapers published in the county in which the Capitol of said state is located, nor was any notice of the time and place when and where the Commission would hear objections which might be urged against said order published or given, nor was any hearing had upon said proposed order, but this Commission made said order of its own motion without notice and without a hearing.

3. This respondent further shows that said order of the Commission dated December 13, 1919, and said order dated January 10, 1920, are in violation of Section 7 of the Bill of Rights of the Constitution of Oklahoma, providing that no person shall be deprived of property without due process of law, and of Sections 23 and 25 of the Bill of Rights of the Oklahoma Constitution providing that private property shall not be taken for either private or public use without just compensation; and said orders dated December 13, 1919, and January 10, 1920, are also in violation of the Fourteenth [fol. 38] Amendment to the Constitution of the United States, which provides that no state shall deprive any person of property without due process of law, nor deny to any person the equal protection of the law, and this respondent hereby claims the benefit of said constitutional provisions.

This respondent states that said orders above mentioned are violative of said constitutional provisions, and particularly of the said 14th Amendment to the Constitution of the United States, in this,

to-wit: Said orders are not in the nature of orders fixing rates for gas, because said orders do not look to the future, but are retroactive in their effect and require merely a deduction, rebate or discount upon an indebtedness heretofore incurred by the patrons of this respondent under existing rates, and said orders purport to require this respondent and the Oklahoma Gas & Electric Company to forego a portion of the money which they have earned under existing rates. This respondent further says that an order requiring it to discount a bill for gas and the indebtedness from a patron to it which has already accrued, because of lack of adequate pressure, legally, logically, and constitutionally could be predicated only upon the assumption that the respondent had not done its duty by its patrons in that it had not exercised due and reasonable diligence to obtain and furnish an adequate supply of gas, when by the exercise of due and reasonable diligence it could have obtained and furnished an adequate supply. The respondent further states that natural gas is a commodity which has natural limitations in the supply thereof, and that when this respondent entered into the public business, it dedicated its supply of gas to the public, but assumed only the obligation of furnishing to the public such quantity as it had and [fol. 39] could reasonably obtain in the vicinity of its pipe lines, and that if this respondent had adequate transportation facilities, and was careful and diligent in its efforts to obtain and furnish gas in adequate quantities to its patrons, and a deficiency existed only by reason of the failing of the supply available, this respondent would be without fault, and the diminished supply of gas and the additional cost of furnishing it would tend toward an increased rather than a reduced price therefor. And if this respondent has been diligent and provident in its efforts to furnish an adequate supply of gas, and the shortage exists only because of the failing and exhaustion of the supply available then its patrons could not legally, morally, or constitutionally refuse to pay the full price for the gas they actually used merely because this respondent was unable to furnish them all the gas they needed or wanted, and that any order requiring the discount or rebating of the bills of its patrons incurred in the past for the gas which they actually used at the prescribed rate merely because this respondent was unable to furnish them all the gas they needed or wanted would operate to deprive this respondent of its property without the process of law and deny it the equal protection of the law, in violation of the Fourteenth Amendment to the Constitution of the United States, and would also take this respondent's property for public and private use without just compensation, in violation of the Constitution of the United States.

This respondent further says that it has at all time had ample transportation facilities, and had at all times been diligent, careful and painstaking in its efforts to provide and furnish an adequate supply of gas to its patrons, and to that end, during the last three years, it has spent $1,556,000 in new mains in extending its pipe lines to new fields, a thing it was under no legal obligation to do. [fol. 40] That said additional investment was not made out of earnings, but was money subscribed by its stockholders for the purpose of

endeavoring to procure an additional supply of gas, that during the last three years this respondent has spent more in an endeavor to procure and furnish an adequate supply of gas than its earnings have been after deducting its operatings expenses. It further shows that the gas fields in Oklahoma are short-lived. It originally got gas from what was know as the Hog Shooter field, which furnished for a time vast quantities of gas, but said field for a number of years has been entirely exhausted. It further shows that the Glenn Pool which originally furnished gas in vast quantities, is now completely exhausted, and there is not now enough gas produced in that entire field to supply even the town of Kiefer, a town of about fifteen hundred inhabitants. It further shows that it built a pipe line into the Cushing field, once a great producer of gas, and that that field is now practically exhausted, all the high pressure gas being gone, and only the low pressure gas in limited quantities being available there now, that in order to take the low pressure gas, this respondent, at a large expense built a compressor station for the purpose of getting the gas out of the wells by suction and pumping it to its patrons, but that the supply in said Cushing field, even of low pressure gas has become so nearly exhausted that but very limited quantities are available there even by means of said compressor station. The respondent further shows that in the year 19— it contracted with the Secretary of the Interior for gas acreage in the Osage Nation, and in its efforts to get gas there it drilled eighteen dry holes at great expense. While it obtained some gas from its acreage in the Osage, the quantity was inadequate and wholly incommensurate with the cost of the operation. The re- [fol 41] spondent further shows that in the year 1917 it spent $8,26,000 in building a pipe line into the Morrison field, which promised a large supply of gas, but all the high pressure gas from that field has been exhausted for some time, and the low pressure gas available there now is in such limited quantities as to be negligible. The respondent further shows that in 1918 some gas wells were developed in the Cement field, about fifty miles southwest of Oklahoma City, of such size as to hold out a reasonable promise of a large supply. In order to supply its patrons this respondent contracted for that gas, and spent a million and a quarter dollars in extending its lines fifty miles to that field. When the wells were connected they rapidly failed, and the gas obtainable there has been negligible. In 1919, the respondent in an effort to procure an adequate supply of gas further extended its lines to the Walters field, about one hundred miles from Oklahoma City, and about fifty miles south of the Cement field, at a cost of a million and a half dollars. It there connected with some large wells but the pressure and volume thereof immediately went down, and the quantity of gas so far obtainable there has been inadequate. In addition to the foregoing, this respondent has made many other shorter extensions to other gas fields and gas wells, has drilled many wells of its own, and has purchased gas wherever it was available in worth while quantities.

This respondent further shows that on November 1, 1919, it had an open flow volume of gas amounting to 585,000,000 cubic feet, of which under the law it was entitled to take 25%, or 146,000,000 cubic feet, a day. This quantity would have been adequate for all the towns and cities served by this respondent; but by December 1, 1919, notwithstanding the continued and diligent efforts of this [fol. 42] respondent to keep up and augment the supply, the open flow volume of gas available to this respondent had become reduced to 358,000,000 cubic feet per day, 25% of which, or 89,000,000 cubic feet, it could take daily, which quantity was inadequate, and which occasioned the shortage of gas and the reduction of pressure.

This respondent further says that in addition to the foregoing it has built and operated numerous and adequate compressor stations for the purpose of pumping the gas from the wells and forcing it through its pipe lines, all at vast expense. This respondent further says that it has omitted no efforts or expenditures that any reasonable, diligent or provident person engaged in the same business, and upon whom rested the same responsibility, would have made in order to secure and furnish an adequate supply of gas to its patrons, and that the shortage in the quantity of gas available and the low pressure at which said gas was supplied is due, not to any negligence, carelessness, incompetency, or indifference on the part of this respondent, but wholly and entirely to the fact that the supply of gas in the State of Oklahoma and accessible to the lines of this respondent has greatly failed and is failing, and that it has become an actual and physical impossibility for this respondent to furnish to its patrons during periods of extreme cold weather all the gas which they may need at the pressure which they desire. And this respondent says that if, under such conditions, its patrons elect not to use coal, wood, oil, or other subsidiary fuel, but elect to take gas from this respondent and to burn the same, then its patrons are under a legal and constitutional obligation to pay to this respondent the full price therefor, and that to require this respondent to forego and release any portion of the indebtedness which its patrons [fol. 43] have incurred toward it for gas used under the prevailing rates is to take this respondent's property without due process of law, deny it the equal protection of the law, and to take this respondent's property for public and private use without just compensation.

This respondent further says that, in order that it may furnish an adequate supply of gas to its patrons for domestic purposes, it does not furnish gas for industrial purposes at all; that during the summer months when its patrons do not heat their houses, the sole use for gas is for cooking purposes, and that the receipts from gas used for that purpose are not sufficient to pay this respondent's operating expenses, and that if it is to be permitted to make and earn a reasonable return upon its investment, it can do so only during the winter months; and that to require it to discount its bills for low pressure during the winter months, is to prevent it, and the said order of the Commission will prevent it, from obtaining any return whatever upon its investment.

This respondent further says that the shortage of gas during the

extreme cold weather in November and December, 1919, was not confined to this respondent. On the contrary, it was nation-wide, and was so serious everywhere that the Secretary of the Interior called a conference to be held at Washington, D. C., on January 15, 1920, of the governors and public utility commissions of the gas states and the mayors of the cities therein and of the gas companies, to devise means for the conservation of the rapidly decreasing supply and for the more efficient use thereof through modern and more efficient appliances. This respondent states that there was a shortage on the lines of every other large gas company in the United States, even greater than existed on this respondent's lines; but no other gas company in the United States has been required to dis- [fol. 44] count its bills on that account.

4. The respondent further shows that the orders of the Commission dated December 13, 1919 and January 10, 1920, requiring the discounting or rebating of the bills for low pressure during November and December, 1919, are arbitrary, unreasonable, and violative of the Fourteenth Amendment to the Constitution of the United States, for the following reasons, to-wit: That in said orders the City of Oklahoma City is divided into districts, and the pressures are taken in each district in said city daily, that a four ounce pressure is treated as normal, and if the pressure has been four ounces during the month the entire bill is required to be paid; that a three ounce pressure is treated as 75% normal, and a two ounce pressure is treated as one half normal, and a one ounce pressure as one-fourth normal; and the bills for gas are required to be rebated in accordance with the pressure and in the proportion which the period of time during which there was a diminished pressure bears to thirty days, that is to say that if in one district in Oklahoma City the pressure is four ounces during fifteen days of the month, and is two ounces during the remaining fifteen days, the Commission orders that the service shall be considered normal during one-half of the time and half normal during the other half of the time, and requires that the bills of all the patrons in that district for the entire month be discounted twenty-five per cent. That said order is arbitrary, unreasonable and unconstitutional, first, for the reason that it takes no account of the actual facts with respect to the individual patrons, that in numerous instances individual patrons residing in the particular district have coal, wood, or oil, and during the periods of extreme cold weather when the gas pressure becomes reduced, [fol. 45] they use such other fuel and take no gas during said period of time, or if they take any gas, it is only a negligible quantity for cooking purposes, so that practically the whole bill incurred by said patrons is made up of gas used when the pressure was normal, for which they ought to pay the entire bill, but said order of the Commission requires the discount or rebate to be made and given to each and every patron of the company in said district, without regard to the particular facts with respect to the particular patron in said district, thus requiring the discounting of bills for service rendered at normal pressure.

This respondent further shows that said order of the Commission

is not based upon the relative heating value of gas at different pressures, but, as stated above is wholly arbitrary and capricious. This respondent avers that the difference between the heating value of gas at atmospheric pressure and at four ounces pressure amounts only to seventeen cubic feet of gas; that is to say, that a container holding a thousand cubic feet, if filled with gas at atmospheric pressure, would require the addition of only seventeen cubic feet of gas to raise it to four ounces pressure, and it would require the addition of only 12.2 cubic feet of gas to raise it to three ounce pressure, and the addition of only 8.5 cubic feet of gas to raise it to two ounce pressure, and the addition of only 4.2 cubic feet to raise it to one ounce pressure. In other words, the difference in the heating value of gas at one ounce pressure and at four ounce pressure is just such heat as thirteen cubic feet of gas out of a thousand would make; and that for the Commission to require a discount of 75% of the bill because of the loss in the heating value of thirteen cubic feet [fol. 46] of gas in each thousand, is to ignore the facts is to act arbitrarily and is to take this respondent's property without due process of law, deny it the equal protection of the law, and take its property for public and private use without just compensation. When this respondent furnishes gas to its patrons in the fullest quantities which it is able to do and at the highest pressure which it is able to furnish, if its patrons are unwilling to pay for the same they should not take the gas but should use other fuel; but if they use the gas of this respondent, they are under a legal and constitutional obligation to pay for the same at the established rates.

The said order of the Commission is not only arbitrary and unconstitutional in requiring the discount upon the basis of the pressure, as above set out, but said order is also unconstitutional in that it provides that gas furnished at less than one ounce pressure need not be paid for at all.

This respondent further says that notwithstanding the supply of gas available to it has failed and is failing, yet this respondent's investment and its overhead expenses remain unchanged, and it is faced with the situation of having to expend each year more than it earns, after paying its operating expenses, as it has done during the last three years, in building extensions to other gas fields, which last only a short time, and that if, notwithstanding its investment and its overhead expenses remain unchanged, nevertheless the supply of gas becomes diminished, the price therefor, rather than being decreased, according to all the laws of economics, would have to be increased, and if this respondent is to be confronted with the necessity of discounting its bills because of the fading gas supply [fol. 47] then it will be unable to make any additional extensions in the future, and it will be faced with early bankruptcy.

Wherefore, for the reasons hereinbefore given, this respondent respectfully protests against the orders heretofore made by the Commission requiring the discounting of said bills, and prays that the Commission will set the same aside.

Oklahoma Natural Gas Company, by Ames, Chambers, Lowe & Richardson, Its Attorneys.

Duly sworn to by R. C. Sharp. Jurat omitted in printing.

[File endorsement omitted.]

[fol. 18] Before Corporation Commission of Oklahoma

[Title omitted]

Statement of Evidence

Transcript of Proceedings had Before the Corporation Commission of the State of Oklahoma Before Commissioners Walker, Russell, and Echols

Hearing begun on the 26th day of January, 1920

Appearances of Counsel

For the Commission: S. P. Freeling, Attorney General, E. L. Fulton, Assistant Attorney General.

For the Oklahoma Natural Gas Company: Ames, Chambers, Lowe & Richardson.

L. J. Sartain, Reporter.

[fol. 19] Colloquy Between Commission and Counsel

Now on this 26th day of January, 1920, the Commission being in session, the following proceedings were had:

Commissioner Walker. This is cause No. 3846, Oklahoma Gas & Electric Company, and Oklahoma Natural Gas Company, in the matter of interpreting charts and determining discounts. Are you gentlemen ready?

Mr. Richardson. Yes sir.

Commissioner Walker. As I understand this case, this was an order made some time ago requiring the Oklahoma Gas & Electric Company, and the Oklahoma Natural Gas Company to refund or rebate bills on account of the shortage of gas. This case was set down for hearing this morning to give the Companies an opportunity to show cause, if any, why this order should not be put in effect, and why the rebates should not be made. Give your appearances to the Reporter.

Mr. Richardson. Ames, Chambers, Lowe & Richardson appear for the Oklahoma Natural Gas Company.

Commissioner Walker. Any other names you care to have go in the record as representing these people, or these folks. Any other appearances you care to have in the record?

Mr. Richardson: No sir, none that I know of.

Commissioner Walker: The witnesses in this case stand up and be sworn. All witnesses.

(Thereupon the witnesses are sworn.)

Commissioner Walker: Have you any statement you want to make, Judge, before we start in with the case?

Mr. Richardson: If the Commission please, the Oklahoma Natural Gas Company desires to file a response to the order to show cause in this case.

Commissioner Walker: You may do so.

(Here counsel for the Oklahoma Natural Gas Company files with the Commission their response to the order to show cause, which is in words and figures as follows, to-wit:)

[fol. 50] Mr. Richardson: In order that the Commission may understand the scope of the evidence that we shall offer, and the purpose to which it is directed, I am of the opinion I should read a portion of the response, and by permission of the Commission I will do so.

Commissioner Walker: Go ahead.

ARGUMENT OF COUNSEL

Mr. Richardson: This response first sets up that the gas furnished and distributed in the City of Oklahoma City is the gas of the Oklahoma Natural Gas Company, and the Oklahoma Gas & Electric Company, by virtue of a contract existing between those two companies, is the agent of the Oklahoma Natural Gas Company in the distribution of the gas and the collection of the proceeds.

The response next directs the Commission's attention to Section 18, Article 9, of the Constitution, which provides that before the Commission shall make any rate, or prescribe any order, rule, or regulation directed against any one or more companies by name, it shall first give to the Company, or Companies, affected, at least ten days notice of the time and place when and where the contemplated action shall be considered and disposed of, and before it shall prescribe any rate or make any order, rule or regulation—I mean any general order—not directed against any company by name, it shall first publish the proposed order in some newspaper of general circulation, published in the city in which the capitol is situated, at least four weeks, and designate the time and place when and where the Commission will hear any objections thereto.

This response then sets out that the order made January 19th, 1920, which was the order for us to appear and show cause why these rates should not be granted, purports to be based upon Order [fol. 51] No. 1374, Cause No. 3223, made on February 9, 1918, and upon Order No. 1509, Cause No. 3615, made on November 6, 1919, and upon a journal entry, in effect a general order made by the Commission on December 13, 1919. Then we show this: That said order No. 1374, made in Cause No. 3223, was an order directed

against the Nowata Gas Company by name, in a proceeding brought before this Commission by the City of Nowata against said Nowata County Gas Company, and in which a hearing was had and testimony taken, not as to conditions prevailing over the State of Oklahoma, but merely with respect to the conditions prevailing in the City of Nowata, and with respect to the conditions prevailing at said time. And said order No. 1374 was a temporary order directed against said Nowata County Gas Company, only, and was not against the Oklahoma Gas & Electric Company, and not against the Oklahoma Natural Gas Company, and neither of said companies were served with notice therein, and neither appeared or were heard therein. Said order cannot therefore, either in whole or in part, be the basis of the order made by this Commission on January 10, 1920.

This respondent further shows that the Commission's Order No. 1589 Cause No. 3615, in which it required all gas distributing companies distributing gas in the State of Oklahoma to install recording pressure guages at all regulator stations, while purporting on its face to be a general order, rule and regulation, not directed against any specific company or companies by name, nevertheless was not published in substance once a week for four consecutive weeks in one or more of the newspapers of general circulation published in the city in which the Capitol of the State is located, together with a notice of the time and place when and where the [fol. 52] Commission would hear such objections as might be urged by any person or company interested, against said order, but on the contrary, said order was not published in its substance at all, and no notice of any time or place when or where said Commission would hear objections to said proposed order was given to this respondent, or to the Oklahoma Gas & Electric Company, or to any one else, but said order was promulgated and was purported to be put in force by this Commission without any hearing or opportunity for a hearing, and without any notice of any kind or character.

This respondent further shows that the said order of the Commission dated January 10, 1920, is merely a statement of the percentage of the discount or rebates required by this Commission to be made upon the bills for gas in the various districts of Oklahoma City, and is based specifically upon the journal entry of the Commission dated December 13, 1919, which required all distributors of natural gas to domestic consumers to discount or rebate the bills for gas for low pressure in accordance with the Commission's order No. 1374 above mentioned, and that said journal entry dated December 13, 1919, is in effect a general order directed to no company by name, but specifically requiring the deduction, rebate or discount of all gas bills for low pressure, and said order of January 10, 1920, only prescribes the percentage of discount applying under said order of December 13, 1919, and that said order of December 13, 1919, is void for the reason that it is a general order, and that the substance of the same as not published once a week for four consecutive weeks, or published at all, in one or more of the newspapers published in the county in which the Capitol of said state is located, nor was any notice of the time and place when and [fol. 53]

where the Commission would hear objections which might be urged against said order published or given, nor was any hearing had upon said proposed order, but this Commission made said order of its own motion without notice, and without a hearing.

Then, if the Commission please, the remainder of this pleads that to require a rebate on bills for gas incurred in the past, is to take respondent's property without due process of law for several reasons. One is, that bills incurred for gas in the past, becomes an indebtedness due from the patron to the gas company under the existing rate and that the order of the Commission can have a prospective effect only, and not retroactive, and after the indebtedness has been incurred, if the Commission makes an order requiring the gas company to forego or relinquish any part of that indebtedness it deprives the gas company of its property without due process of law and in violation of the 14th Amendment of the Constitution of the United States, and also in violation of the constitution of the State of Oklahoma. We also state that there could be only two bases for making a rebate or discount. One would be negligence on the part of the gas company in an effort or endeavor to furnish an adequate supply of gas. If the gas company has been negligent and has not exercised proper diligence and reasonable care to acquire and furnish an adequate supply of gas, then it might be liable for its negligence and the rebate in the nature of damages might properly be awarded. The other would be this. That assuming that the gas company was not negligent but had exercised a reasonable care [fol. 54] to furnish an adequate supply, nevertheless, if the meters incorrectly registered it, or if the party was charged with gas which he did not get and the gas company was endeavoring to make him pay for gas which he did not get and use, then the Commission might determine whether he has actually gotten the amount of gas with which he was charged, and if not, then the Commission might order the bill related down to the amount he did actually get. Those two conditions are the only ones as we conceive it, under which an order requiring a rebate would be justified. We say that neither of those conditions exist. We say the gas company has not been negligent in an effort to secure and provide an adequate amount of gas, but on the contrary it has put forth every reasonable effort to procure and supply a reasonable and adequate supply of gas at a proper pressure, and that upon the times and occasions when the quantity has not been adequate it has been due to no negligence or indifference on the part of the gas company, but solely to the fact that an adequate supply was not available and that was a thing that was beyond the power of the gas company to remedy, and therefore it could not be required to rebate upon that ground. I may state also in that same connection, as our theory of the law supporting that, and the courts all hold that that is the proper theory, that the duty of a natural gas company to provide and furnish an adequate supply of gas is not absolute and cannot either by any order of a Commission or by any Act of the legislature, be made absolute. It is the only person engaged in a public service that furnishes a commodity the supply of which is limited by na-

ture, the supply of which has natural limitations, and a thing which once used can never be manufactured over or brought into existence again. An electric light company manufactures its service, and the only factor entering into the question of an adequate supply [fol. 55] is merely a sufficient investment to procure sufficient machinery and competent management in order to render it; other companies bear the same relation to their industries, but in the natural gas business, the supply is that which has been created by nature itself. It is something that man cannot create and does not create, and when the supply fails, or when it has once been used, it is beyond the power of any human agency to create it over, and all that a human agency can do is to provide facilities to carry an adequate supply, and exercise reasonable diligence to procure and furnish an adequate supply, and if that is done, and the general supply is not adequate, it has done all that it can, and to say that its duty to furnish an adequate supply is absolute, is to take its property without due process of law and in violation of the 14th Amendment to the Constitution of the United States. The Supreme Court of the United States holds that.

Passing from that question then, the next question is whether or not, when one consumer we will say used a thousand cubic feet of gas at four ounces, that is at four ounce pressure, and another consumer on another occasion used a thousand cubic feet of gas at one ounce pressure, there is such a discrepancy between the amount of gas which he has obtained and used and the heating value of the gas that he has obtained and used, as would justify the Commission to make an order providing that for the gas furnished at four ounces pressure he should pay the full bill, and for that gas furnished at one ounce pressure he should only pay 25% of the bill, and for gas furnished at less than one ounce pressure he should not pay anything? The evidence that we proposed to introduce in this case will [fol. 56] show that the difference between one thousand feet of gas furnished at four ounces pressure, and a thousand cubic feet of gas furnished at one ounce pressure is only about 12 cubic feet of gas in a thousand, and that the gas furnished at one ounce pressure actually has more heating units in proportion to the quantity of gas, than the gas at four ounces. We propose to show that the difference between gas furnished at four ounces and three ounces is only about four and a half feet in a thousand, and that the difference between gas furnish at four ounces and two ounces is only about eight and a half cubic feet in a thousand, and as I stated, that the difference between gas furnished at four ounces, and one ounce is only about twelve cubic feet in a thousand. Now if that is true, then our position is that the Commission cannot say to the patron that if you got gas at one ounce pressure, which was only about 12 cubic feet of gas in a thousand less than if it had been furnished at four ounce, you may be accepted of all of your bill incurred in the past during that period excepting 25% of it. If the Commission is going to require rebates or discounts in proportion to the amount of gas furnished according to pressure, then it must conform to the actual

facts and that it cannot make an order and fix it arbitrarily at a certain pressure without regard to the amount of gas a man is getting, and without regard to the heating units contained in that gas. The evidence will also show that a campaign with regard to the use of low pressure gas has been undertaken by the company to be carried on. That demonstrations have been advertised, and the people would not attend them; that there is no other public business in which the character of the service rendered depends so much upon [fol. 57] the consumer himself as that of furnishing natural gas. The company can furnish the gas and deliver it to a man's service line, but the size and capacity of his service lines and the condition in which he maintains them, the character of his burners and the condition in which he maintains them, the nature and character of his appliances for burning gas and utilizing the heat in the gas is something he must furnish himself, and regulate, or have someone else regulate, and that is something that depends on him; those are things that he must provide and furnish himself, and to say that if he remains wilfully ignorant on the subject and does not provide proper appliances, or if he has proper appliances and does not keep them properly regulated, that the gas company's bill should be discounted because he does not do that and therefore does not utilize the full heating value of the gas, is to take the property of the gas company without due process of law. We also contend that the order is arbitrary, and unjust, and unreasonable, because it is not based upon the actual conditions that confront any particular individual who would get the rebate. It isn't based in any particular district with regard to the patrons who used coal or wood, or oil during periods of low pressure and is without regard to the particular facts with respect to the particular patrons in such district and thus require the discounting of bills for gas furnished at normal pressure. We think the evidence will show that in each and all of the districts where the Commission has provided for rebates, that there were a great many people who used coal or wood during periods of low pressure, and who came to pay their bills saying that their bill should not be so high because they were burning coal during times of low pressure, and all of whose bills, except probably an in- [fol. 58] significant amount for cooking, was incurred during periods when the pressure was normal, and yet each and all of those persons, without distinction or investigation as to the particular conditions which confront each particular person, would have a rebate just the same whether under the existing facts they were entitled to it or not. We say that of itself would operate to deprive us of our property without due process of law. This is a judicial proceeding and the order of the Commission is in the nature of a judgment or award to those people and it must operate upon information and ascertain the facts with respect to each and every person who gets the benefit of that judgment, and could not, arbitrarily be made to apply to everybody in a particular district without regard to whether or not he was really affected. Those are the principal facts that we set forth in this response. We also set forth the efforts that have been made to furnish gas and the expenditures that have been made. In

the last three years the Oklahoma Natural Gas Company has spent in an effort to procure and furnish an adequate supply of gas over a million six hundred thousand dollars more than its net earnings were. In other words, after paying its operating expenses, the amount it invested of new money, new capital raised by its stockholders in an endeavor in this state to provide and furnish an adequate supply of gas exceeds its net income by a million six hundred thousand dollars. We will show where that has been spent. We say, under the circumstances, that the order of the Commission, undertaking to require us to rebate our bills would operate to deprive us of our property without due process of law, and therefore would be unconstitutional, and that in addition to that, it is arbitrary, unlawful, and unjust.

[fol 59] There is another matter to which I have not called the Commission's attention to this, and it is a matter of our own statute. Our legislature in 1913, after it passed the Act giving the Corporation Commission jurisdiction over Public Utilities—that Act was passed March 5th, 1913,—on April 9, 1913, the legislature passed an act saying that gas should be sold only through standard meters, and at meter rates. The question of pressure never entered into it, and the question of pressure never entered into any order of the Commission fixing rates. The Act of the Legislature did not require that gas be furnished through standard meters at meter rates in accordance with pressure, but said that gas should be furnished through standard meters at meter rates and made it a misdemeanor for gas companies to furnish gas on any other basis. That is the only statement I have to make.

Commissioner Walker. All right, call your first witness.

Colloquy Between Commission and Counsel

Mr. Richardson. Now if the Commission please, there are some other matters that I think probably we might agree upon. There does not seem to be any attorney representing the Commission.

Commissioner Walker. Mr. Thraves, the attorney representing the Commission is unable to be here. His wife is very ill, in the hospital, and we will have to get along without an attorney.

Mr. Richardson. I thought there were some matters we might agree upon so as to save the necessity of making proof. The first averment is that the gas distributed in the city of Oklahoma City is the property of the Oklahoma Natural Gas Company, and is distributed through the Oklahoma Gas & Electric Company, under a written contract existing between the Oklahoma Natural Gas Company and the Oklahoma Gas & Electric Company whereby the Ok-[fol 60] lahoma Gas & Electric Company distributes the gas as the agent of the Oklahoma Natural Gas Company for a certain percentage of the collection. That contract is on file with the Commission, and the Commission has seen it, and has had it before them on sev-

eral occasions. Can we stipulate and agree in this record that that is true?

Commissioner Echols Mr. Owen, I think that statement is approximately correct, is it not?

Mr. J. F. Owen. Yes sir.

Commissioner Echols. I think that can be agreed to.

Mr. Richardson. All right. Now in regard to order 1374, made in cause No. 3223, I have averred that was an order made in the case of the City of Nowata against the Nowata County Gas Company, by name.

Commissioner Walker. It may be that we can get one of the boys from the Attorney General's office to help out. If you folks care to we will take about five minutes recess and see if we can't get one of the attorneys from the Attorney General's office to come up.

(Thereupon recess is taken for a few minutes.)

Thereupon the commission reconvenes, the Commissioners being present, and represented by S. P. Freeling, Attorney General, and F. L. Felton, Assistant Attorney General.

Commissioner Walker. All right Judge, you may go ahead.

Mr. Richardson. If the Commission please, in this response I have alleged certain facts in regard to the previous orders of the Commission. I think those facts are within the Commission's judicial knowledge, but of course, they would not be within the judicial knowledge of any reviewing tribunal, and I have endeavored to [fol. 61] allege them correctly as I understand it and I wanted to see if we could not agree as to the facts with respect to those orders without having to encumber the record with a great deal of evidence in regard to that. Now, for instance, I have alleged here that Order No. 1374 was made in Cause No. 3223, and that that was an order directed against the Nowata Gas Company by name.

Commissioner Russell. That is correct.

Mr. Richardson. And that neither the Oklahoma Gas and Electric Company, nor the Oklahoma Natural Gas Company was a party to that proceeding?

Commissioner Russell. That is correct.

Mr. Richardson. And that no notice was served upon either the Oklahoma Natural Gas Company, or the Oklahoma Gas & Electric Company in the proceeding which resulted in Order No. 1374.

Commissioner Walker. That is correct.

Mr. Richardson. As I understand, the Commission agrees that is correct. Now then, order No. 1580, made in cause No. 3515, was one requiring all gas companies distributing gas in the State of Oklahoma to install recording pressure gauges. Inasmuch as that order was not directed against any particular company by name, it would come under what is known as a General Order, and I want to inquire of the Commission whether or not that was published?

Commissioner Walker. I could not say without looking it up.

Commissioner Russell. We had a general hearing on that but as to whether it was published and each individual company sent a

notice, I would not be sure without the record being produced, but we did have a general hearing. You doubtless remember that

[fol. 62] Commissioner Walker. Yes, we had one eight or nine months before that order was issued.

Mr. Richardson. I would not ask the Commission to agree unless they know the facts, we will pass that until we have an opportunity to take it up later on. Now then, the journal entry of the Commission which was dated December 13, 1919, which required all distributors of natural gas to domestic consumers to discount or relate the bills for gas at low pressure in accordance with the Commission's Order 1374, above mentioned, and I will ask the Commission whether or not—in the first place, whether that was a General Order, and not directed against any gas company by name. That is true is it not?

Commissioner Walker. Do I understand you claim that was to all gas companies in the state?

Mr. Richardson. Yes sir, the Commission's Order so recites.

Commissioner Walker. That was not directed to the Oklahoma Natural Gas Company, or the Oklahoma Gas & Electric?

Mr. Richardson. No sir.

Commissioner Russell. As I understand it, that was intended as notice to the gas companies as to what the Commission's position was.

Richardson. I am not taking it that way. I just want to show the facts. Now in the findings of fact in this case an order made—this order 3615, made on the 6th day of November, 1919, requiring all gas companies to install recording pressure gauges. Was there a hearing on that?

Commissioner Russell. I think we had somebody testify.

Mr. Richardson. A general hearing?

[fol. 63] Commissioner Walker. The hearing was several months before.

Commissioner Russell. That was when Judge Humphrey was here.

Mr. Richardson. We will pass that then. We were talking about the Journal Entry made on Dec. 13, 1919. The Commission caused a Journal entry to be issued, which provides as follows. This is on the 13th of December, 1919:

"All distributors of natural gas to domestic consumers in the State of Oklahoma are hereby notified to deduct from the gas bill of each domestic consumer for such low pressures in accordance with Commission's Order No. 1374.

All gas distributors are further notified not to discontinue service to any domestic consumer for failure to pay any gas bill which does not make proper reduction for insufficient service as provided in said order."

Now that was the Journal Entry of December 13, 1919, and I want to ask the Commission if any notice was given of that hearing or any hearing had upon the promulgation of that order?

Commissioner Walker. That is the last order?

Mr. Richardson. Yes sir.

Commissioner Walker. There was not. That was when the order was issued, and that is the purpose of this hearing here today. You are here to show cause why that order should not be enforced.

Mr. Richardson. We are now to have a hearing as to whether there shall be a rehate for the purpose of establishing a rule?

Commissioner Walker. Yes sir.

Mr. Richardson. Now I wish also to call the Commission's attention, before I proceed further, to its Order 1379, in causes 3188, 3192 and 3197, being the causes of Ruth Donnell and Selby against the Oklahoma Gas & Electric Company and the Oklahoma Natural [fol. 64] Gas Company. Those were particular complaints, filed by particular persons, upon a particular occasion, alleging a particular shortage at that time. In those cases notice was served upon the defendant Companies and a hearing was had and the Commission made an Order, and in that order it was recited that this was made in view of the particular conditions existing then. The Commission said this:

"The rule adopted in this case must necessarily fail when the day does come when there is an actual shortage of gas available though ample transportation facilities exist, since after partial failure of the supply there will be, as the same continues to decrease, some cause for a partial, as distinguished from a full service."

Then the Commission said:

"All users of gas might well exercise the precaution of preparing for use of other fuel as an adjunct to gas for fuel in times of severe cold, and as a substitute therefor, when they are unwilling to abide by the generally accepted manner of means of measuring the same."

In other words, the point I am undertaking to show is that this was not a General Order directed to no particular company by name and having the force and effect of a general law, but was a hearing had and a judgment rendered upon a particular complaint, alleging a particular state of facts existing at that particular time. Now is there any controversy between us and the Commission in that respect?

Commissioner Walker. The record shows for itself.

Mr. Richardson. All right. Now Mr. Wyer, will you take the stand, please sir.

[fol. 65] Samuel S. Wyer, being called as a witness on behalf of the Oklahoma Natural Gas Company, having been first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Mr. Wyer, your name is Samuel S. Wyer?
A. Correct.

Q Where do you live?
A Columbus, Ohio.
Q In what business are you engaged, Mr. Wyer?
A Consulting Engineer.
Q How long have you been engaged in that business?
A I have given practically all of my time to public utility problems. First, on public utility problems general, and in the last eight or nine years specializing on natural gas problems—since about the year 1908 or '09.
Q Are you a graduate of any school of Engineering?
A Graduate of the Engineering College of the Ohio State University.
Q Mr. Wyer, just to save time, will you state to the Commission, I think you have it outlined in previous testimony given by you, what your qualifications are, and if you desire, you may refer to that to refresh your recollection in respect to the things and matters which you have undertaken and done.
A I have made a special study of public utility problems with special reference to natural gas. In 1905 I published a book on Production of Gas and Gas Producers, and in 1913 I published a book on Regulation, Valuation and Depreciation of Public Utilities, and have prepared a large number of reports and statistics covering various phases of natural gas industry since that time.
Q Have you been associated in any way with the United States Bureau of Mines?
[fol. 66] A I have acted in a consulting capacity for the United States Bureau of Mines for a number of years.
Q Have you prepared any reports or documents for the United States Bureau of Mines?
A I have prepared a report on Waste and Correct use of Natural gas in the home, which has been published as Technical paper No. 257 of the Bureau of Mines.
Q Have you prepared any reports which have been adopted and published by the Smithsonian Institute?
A I have prepared a report on the general subject, Natural Gas; Its production, service, and conservation, which has been published by the Smithsonian Institution at Washington, D. C. as part 7 of its bulletin 102, Mineral Resources of the United States.
Q Have you acted in conjunction with any Public Utility Commission in the United States?
A I have prepared an extensive report on the subject Conservation of Natural Gas in the State of Pennsylvania, for the Public Service Commission of that State. This report was prepared a little over a year ago, the letter of transmittal to the Public Service Commission of Pennsylvania being dated December 28th, 1918.
Q Was that report printed and circulated at their expense?
A It was, and has been printed by the Public printer of the State of Pennsylvania, under the title "Supply and Conservation of Natural Gas in the State of Pennsylvania."
Q Did you attend the recent conference which was called by the

Secretary of the Interior to be held at Washington, on December 15th, 1919, in regard to the conservation of natural gas?

A. I did. The date, however, was January 15th, 1920.

[fol. 67] Q. Did you attend that at the instance of the Secretary of the Interior?

A. I did. The Bureau of Mines made a special arrangement for me to act as Consulting Engineer for the Bureau for the entire Natural Gas conservation program.

Q. Have you made a study or any tests as to the quantity, the actual quantity of gas and the number of heating units contained in gas at different pressures?

A. I have.

Q. Are you qualified—do you know, and are you qualified to testify to the Commission what the relative quantity of gas in a given volume is at different pressures, and what the relative heating value of the same quantity of gas at different pressures, is?

A. I am.

Q. I will ask you to state to the Commission first, what do you mean when you speak of gas at Atmospheric Pressure?

A. The term Atmospheric Pressure refers to the pressure exerted by the weight of the atmosphere as it exists above the surface of the earth, and as it bears downward toward the surface of the earth. It is a variable factor, depending on the density of the atmosphere and is usually referred to by the name of the instrument that is used for measuring atmospheric pressure, namely, the Barometer, from which is derived the term Barometric Pressure. Barometric Pressure and Atmospheric Pressure mean the same.

Q. Do you know what the atmospheric pressure is in this vicinity or community?

A. I could not give you what the exact pressure is.

Q. It is something—I understand it to be around 14.4 pounds, would that be somewhere correct?

A. That would be substantially correct. The Weather Bureau [fol. 68] could give you the exact pressure.

Q. When you speak of gas at atmospheric pressure, do I understand you to mean that the gas in a container has the same pressure as the atmosphere on the outside?

A. Yes, the container of course, to have that condition, must be open to the atmosphere.

Q. So that the pressure of gas inside the container just equals the pressure on the outside, then the gas is at atmospheric pressure?

A. Correct.

Q. If you have a container which holds 1,000 cubic feet of gas and you fill it full of gas at atmospheric pressure, how much gas would you have to add to the gas inside of the container in order to bring the pressure of the gas inside the container to one ounce?

A. The increase would be determined by the application of Boyle's law of volume. That the volume of gas—the amount of gas at constant temperature varies inversely as the absolute pressure. The term "absolute pressure" being used to represent the sum of the atmospheric pressure and the pressure indicated by the pressure

guage. The difference for the condition you have indicated would be about four and one half cubic feet.

Q. If I understand you correctly, then, in order to raise a volume of gas in a container holding 1,000 cubic feet of gas from atmospheric pressure to a pressure of one ounce, it would be necessary to add to the gas in the container only about four and how much?

A. I have a table here that has the increment from zero to two ounces, and I am reading between, you would have to add to the gas in the container about four and half cubic feet. To state it [fol 69] this way, the difference between atmospheric pressure and a two ounce pressure reading directly from the table would be about nine tenths of one per cent. (.9%.)

Q. Now if you have 1,000 cubic feet of gas in a container, at atmospheric pressure, and you wished to raise it to two ounce pressure, how much gas would you have to add to that container in order to do so?

A. In round numbers about nine cubic feet.

Q. If you have 1,000 cubic feet of gas in a container at atmospheric pressure and you wished to raise it to three ounce pressure, how much gas would you have to add to it in order to produce that pressure?

A. About thirteen cubic feet.

Q. If you have 1,000 cubic feet of gas in a container at atmospheric pressure, and you wished to raise it to a four ounce pressure, how much gas would you have to add to it in order to produce a pressure of four ounces?

A. About seventeen cubic feet, in round numbers.

Q. Do I understand you to say then that the only difference between the quantity of gas in a container at one ounce pressure and the quantity of gas in the same container at four ounce pressure, assuming it held 1,000 cubic feet would be only about thirteen cubic feet?

A. No, seventeen cubic feet.

Q. No, understand me. I am not asking about atmospheric pressure. I said the difference between one ounce, and four ounces?

A. Your statement is substantially correct.

Q. Then the difference between the amount of gas in a container holding 1,000 cubic feet of gas at four ounce pressure and at two ounce pressure, would be about eight and one half cubic feet, would it?

[fol 70] A. Approximately.

Q. Then the difference between the amount of gas in the container holding 1,000 cubic feet of gas at four ounce pressure and three ounce pressure would be about four cubic feet of gas?

A. Approximately.

Q. And that would be the difference in the quantity of gas in each thousand cubic feet at those different pressures?

A. Correct.

Q. Ask you to state to the Commission what would be the relative difference in the heating quantity, or efficiency of the gas at those different pressures?

A. If you will merely change the volume,—the figures that I have given you into terms of percentage you get the relationship, that is, at four ounce pressure the heating value of a cubic foot would be about 1.7% larger than it is at atmospheric pressure.

Q. Now the heating value of a cubic foot of gas at—or say 1,000 cubic feet of gas at four ounce pressure would be how much larger than it would be at one ounce. Probably I can shorten that. Would it be in the same proportion as the quantity you have already given?

A. Exactly.

Q. Is there any difference in the efficiency of gas burned at different pressures?

A. You mean as between one ounce and four ounces?

A. Yes, and the grades between that.

Q. The efficiency in general will be higher at lower pressure if the appliances are properly adjusted.

Q. Mr. Wyer, I understand Miss Elfritz wants to get away tonight, and I see your testimony is going to be rather prolonged and in regard to the demonstration she is to make I thought per-[fol. 71] haps we had better have the demonstration now, and we can finish with your testimony afterwards.

A. I believe we can finish with both of us. It will not take very long for the demonstration.

Q. Very well. Mr. Wyer, the Ohio Public Utilities Commission has reported to the Corporation Commission of Oklahoma the following statement, and I wish to read it to you and ask you to state whether or not it is correct.

"The meter will register the same amount of gas regardless of difference in pressure. In other words domestic meters measure volume, irrespective of pressure. The relation of pressure to heating value is illustrated as follows:

One Thousand cubic feet of gas at atmospheric pressure will give a certain amount of heat. The heat of 1,000 cubic feet of gas at one ounce pressure will give the equivalent of 1,004.2 cubic feet. The heat of 1,000 cubic feet of gas at two ounce pressure will give the equivalent of 1,008.5 cubic feet. The heat of 1,000 cubic feet of gas, at three ounce pressure will be the equivalent of 1,012.7 cubic feet. The heat of 1,000 cubic feet of gas at four ounce pressure will be the equivalent of 1,017 feet."

Ask you to state whether or not that is correct?

A. That is a correct statement.

Q. Mr. Ed C. Connor, Chief Engineer to the Supervisor of Public Utilities of Dallas, Texas, prepared an article which was published in the Dallas News, and which I have here, and I state to the Commission that I desire to offer this as the testimony of Mr. Connor. We have endeavored to get Mr. Connor here, but could not. We have both written and wired him.

Commissioner Walker. We wired Mr. Connor, and he said he could not be here.

Mr. Richardson: And rather than to continue the case we understood that we might read this article in lieu of his testimony.

Mr. Freeling: There is no theory of law on earth where that is competent. That is just an article published in a newspaper, is [fol. 72] it not.

Mr. Richardson: Yes, but the nature of the article it speaks for itself. It is a technical matter.

Mr. Freeling: Suppose we found it published in the Cat?

Commissioner Russell: It would be admissible all right.

Mr. Richardson: Do I understand that we have permission to introduce this article?

Commissioner Walker: You may read it. I don't see any objection to introducing it.

Mr. Freeling: It certainly is not admissible, but if there was an agreement that they might use the article rather than to continue the case to get the witness here or take his deposition, we shall not object.

Mr. Richardson: I will now read this article: "Because of many requests for information regarding the possibility of paying for gas a customer never gets and because of complaints charging that bills are higher during low pressure periods, Ed C. Connor, chief engineer to the Supervisor of Public Utilities, has prepared a report in explanation. According to Mr. Connor's report, which Mr. Milam is enclosing in answer to these requests and complaints, there would be only slight variation in the amount of gas bills regardless of pressure, as the actual amount of gas used is the basis of calculation.

Mr. Connor said it is a fallacy to believe that when the pressure is low the meter registers more rapidly, and in his letter which follows, explained the working of the meter with relation to pressure:

'Referring to recent letters complaining of relatively high gas bills during low pressure periods, and more particularly to the point raised in regard to the question as to whether or not the customers of the [fol. 73] Dallas Gas Company are paying for more gas than they receive, owing to inadequate pressures, I beg to submit the following analysis.

The meters used by the Dallas Gas Company are displacement meters, and the difference in the amount of gas delivered would be directly proportional to the actual gas volume, as determined by the comparative pressures. This fact being based on the fundamental law that the volume of a given quantity of gas is inversely proportional to its pressure.

Assuming, therefore, an atmospheric pressure at Dallas of 14.4 pounds, and that the meter of the customer is tested and regulated on a delivery pressure of four ounces above atmosphere, the absolute pressure of the gas measured and delivered at this pressure would be 14.650 pounds. Assuming that during the period covered by the meter reading, the pressure of delivered gas is two ounces above atmospheric pressure, the absolute pressure of the gas delivered under these conditions would be 14.525 pounds. The difference, therefore, between these absolute pressures is .125 pounds. Expressed in percentage of difference, this is represented by the fraction, 125-

14.650, or .008. In other words, a cubic foot of gas passed through a displacement meter at 14.650, would in effect be .008 greater in actual quantity delivered than a cubic foot of gas delivered at the lower pressure indicated, or 14.527.

Reducing this analysis to a question of dollars and cents, should a man be billed $10.00 for gas based on a constant absolute pressure of 14.650, and the gas actually delivered at 14.525, which would represent a 50 per cent reduction in actual gas pressure above atmospheric pressure for the entire period of the billing, the difference in his gas bill would be less than eight cents for the period.

[fol. 74] As a matter of fact, the meters used by the Dallas Gas Company are tested both by the City Gas Inspector and themselves for an absolute pressure of approximately 14.40, or one ounce above atmospheric pressure. It will be seen, therefore, that any gas being used would be registered with a considerably smaller percentage of error than that indicated above."

Commissioner Walker: I don't see any objection to this going in the record for the reason the state has no witnesses here today to offset this anyway and it would be a matter of rebuttal of several things the witness might testify to.

Commissioner Russell: I understand it goes in the record as a newspaper article or statement, to call out attention to the matter, but when it goes in the record it does not go in the record as a conclusive fact that is proven.

Mr. Richardson: I am not asking that the Commission admit that it is true, but I want it to go in as the testimony of Mr. Connor. Otherwise, I shall want to take his deposition.

Mr. Freeling: If the Commission has said it may go in we will make no objection, but as a matter of law I don't think it is admissible in any sense. You can take scientific reports from recognized authority,——

Mr. Richardson: Except for the understanding that I could introduce this as the testimony of Mr. Connor I would want to take his deposition.

Commissioner Walker: I think we will admit it, because the Commission did wire to Mr. Connor, and asked him to come here, and we received a wire that it would be impossible for him to be here. We will admit it as the testimony of Mr. Connor. You may go ahead.

[fol. 75] Commissioner Russell: I think the first part of that the Public will agree is a fact, that the low pressure operates the meters faster.

Mr. Richardson: How is that?

Commissioner Russell: That it operates the meters faster when the gas is low.

Mr. Richardson: He says it does not operate them faster. If the Public agrees that it does operate them faster at low pressure the public agrees to something that is not a fact.

Commissioner Walker: We will recess now until two o'clock.

Mr. Richardson: If the Commission please, we want to get through with some of these witnesses who want to get away, and would it be agreeable to meet at one o'clock instead of later.

Commissioner Walker. We will meet at one o'clock then, and at two o'clock we will adjourn and go down-stairs for the demonstration.

Thereupon the Commission recessed until 1.00 P. M.

Duly convened at 1.00 P. M., all parties being present as at the time of recess. The witness Samuel S. Wyer resumed the stand for further direct examination by Mr. Richardson, as follows:

[fol. 76] Q. Mr. Wyer, suppose the gas is furnished at only one half ounce pressure, and the meter registers 1,000 cubic feet, what quantity of gas will have passed through the meter as compared with gas at atmospheric pressure?

A. About 1,002.5 feet.

Q. Is it possible for gas to be furnished at one half ounce pressure?

A. It is.

Q. Now recapitulating a portion of your previous testimony, I want to suppose that there are four users of gas residing in four different parts of a city, and that each user during the day consumes 1,000 cubic feet of gas. I want to assume that that 1,000 cubic feet was furnished to the first user at a four ounce pressure, that the 1,000 cubic feet was furnished to the second user at a three ounce pressure, and that the 1,000 cubic feet was furnished to the third user at a two ounce pressure, and that the 1,000 cubic feet was furnished to the fourth user at a one ounce pressure, and with your permission, I will add another, a fifth user, and say that he gets gas at a one half ounce pressure, 1,000 cubic feet. Will you state to the Commission what relative quantity of gas each of those five users of gas got, and how much, in heating value, or quantity, each got, if one got more than the other?

A. Assuming that atmospheric pressure would be the basis for making the comparison—I am using 1,000 cubic feet of gas as the basis, at atmospheric pressure, the consumer at four ounces secured the equivalent of 1,017 cubic feet of gas; the consumer at three ounces received the equivalent of 1,013 cubic feet of gas; the con-[fol. 77] sumer at 2 ounces received the equivalent of 1,009 cubic feet of gas, and the consumer at one ounce received the equivalent of 1,005 cubic feet of gas, while the consumer at one-half ounce received the equivalent of 1,002.5 cubic feet of gas.

Commissioner Russell. Judge, I would like to ask the witness a question if it won't interfere. Can these various pressures referred to in the former question be efficiently and economically used through the same equipment?

A. With proper adjustment of the equipment, yes, but equipment that is adjusted for a four ounce pressure, when the pressure drops down to one-half ounce will require readjusting. That is the fundamental reason why, because of the natural gas operating conditions, it makes it impossible to maintain absolute uniform pressure conditions along the line, it will give better service if the apparatus is adjusted for lower pressures and only lower pressures are carried and used in the house.

Commissioner Russell How many adjustments would be proper to make between the one half ounce pressure and a four ounce pressure?

A No definite statement can be given, because it depends on the type and construction of the apparatus. For instance, in the ordinary natural gas range which is grossly inefficient because it is designed to burn gas rather than to save it, the gas consumption if the gas is used as the ordinary housewife use it, at four ounces it will be much larger than—larger for the same service than if it had been furnished at a pressure of one ounce providing the same relationship is maintained, that the vessel is lowered, or the burners raised, or that the air shutter on the mixer is properly adjusted so as to get a clean cut blue flame in every case.

[fol. 78] Commissioner Russell Is that such an adjustment that the ordinary housewife can make?

A It is.

Commissioner Russell If there is some plan that we could inform her how to do that I wish you would tell us. She certainly doesn't know it.

Mr Richardson Probably some of this testimony will explain some of that. We propose to show that we have endeavored to instruct the people in regard to the matter and have given tests and demonstrations, and they have been very sparsely attended. I am going to tough on that further on, but am not quite ready for it now.

Commissioner Russell All right.

By Mr Richardson:

Q In so far as the quantity of gas that a person gets at different pressures out of each 1,000 cubic feet of gas, is concerned, that was your testimony?

A Yes.

Q Is the heating value of the gas higher or lower at four ounces or at a two ounce pressure?

A If you assume the same temperature——

Q What do you mean by if you assume the same temperature?

A Let me answer the question first. If you assume the same temperature the heating value of natural gas at four ounces would be about nine tenths of one per cent higher than it is at two ounces. The actual conditions however, that prevail under routine operating conditions in winter when you are troubled with low pressure as compared with higher pressures in summer, is that in the winter time the temperature of the gas itself is very much colder and each five degrees variation or decrease in the temperature of the gas makes in round numbers one per cent increase in the heating value [fol. 79] of the gas, or a change in density, therefore the general statement may be made that in winter time during the low pressure period the heating value of the gas as delivered to a meter, and through the consumer's meter, and as burned at the consumer's appliances is several per cent larger than it is in the summer time during high pressure.

Q Now you have testified in regard to the relative quantity of gas contained in each 1,000 cubic feet of gas at a certain pressure. Will the meter deliver and register gas as fast at a two ounce pressure as it does at a four ounce pressure?

A Well the pressure will have no effect on the registration of the meter. That is, it merely measures the volume without reference to pressure.

Q I did not state the question properly. Will the same volume of gas pass through the meter in the same period of time if the pressure is two ounces as will pass through the meter if the pressure is four ounces?

A No. A higher pressure will make the meter run faster. That is for this reason. Not that the pressure itself has any effect on the mechanism of the meter but it will provide enough differential heat so the gas will flow faster through the pipe and the meter merely registers and records that which flows.

Q Then if one man is getting his gas at a four ounce pressure and another man is getting his gas at a three ounce pressure and another at two ounce pressure, and another at one ounce pressure, assuming that the meters are correct and register properly, is it true that the man who is getting the gas at a pressure of one ounce has his meter running faster than the man who is getting his gas at a pressure of four ounces?

A It is not.

Q Is it true that the man who is getting his gas at two ounces [fol. 80] is getting more, or that his meter is running faster than the man who is getting his gas at four ounces pressure?

A It is not.

Q Can you state to the Commission what relative quantity of gas will pass through a meter at those various pressures?

A I have not any data prepared. The amount of gas that will pass will decrease as the pressure goes down——

Q But the meter only registers——

A Let me answer the question first. That data has all been worked out and can be put in if you want it, but I do not have it before me now.

Q I understand. But if the gas is delivered more slowly at a lower pressure is it true that the meter in fact only registers what is being delivered, and that is all that will be charged and collected for?

A Meters always. I am referring to the domestic type—merely register the amount that passes through on the basis of volume without any reference to pressure.

Commissioner Russell: But the meter that is only half open at a six or eight ounce pressure will not register as much as the meter that is turned wide open with a one ounce pressure, would it. How is that?

A I don't understand the question.

Commissioner Russell: Will the meter, with the cocks wide open at a one ounce pressure register more than the meter with the cock half open at six ounce pressure?

A. You cannot answer that because you don't know what the effect of half open and wide open would have upon the friction. In either case the meter would register the exact amount of gas [fol. 81] passing through. Of course when the gas cock is only partially open less gas could go through than when it is wide open. As to whether the statement of a half open cock—which of course would have no relationship at all to the size of the opening in the cock, under that condition no accurate statement could be made.

Commissioner Russell. That is the condition in common use. As the gas goes down we turn it wide open, more and more until we have it wide open as much as we can get, and still no results.

A. No result because you do not use the gas properly. If you will use the gas properly in the appliances for using it either to heat with or for cooking, you can get not only as good, but better service at low pressure than you can at high. It is especially true in connection with the operation of the ordinary cooking range. That range if properly adjusted and by properly adjusted I mean an adjustment that can be easily made by the ordinary house wife, will cook with less gas at one half ounce pressure than the four ounce pressure as ordinarily used. In the heating stove you have this situation. That there is no adjustment that you can make that will give you any more heat. When you have burned the gas with perfect combustion, you have gotten all the heat that you can get out of it. If you utilize that in the right sort of device you can get the same efficiency, that is, the same ratio of in-put and out-put at one pressure as another. However, what happens with the heating stove is that there is not enough gas to go around and for that reason the public complains because the operating conditions are such that in extremely cold weather as at the present time, it is impossible to take care of that [fol. 82] big load. That condition will become more acute each year. However, so far as cooking is concerned, the load is practically uniform, and entirely satisfactory operations can be carried on with very low pressure and meals can be cooked with the pressure as low as three tenths of an inch water pressure, which would be equivalent to about fifteen one hundredths of one ounce (.15 oz.).

Mr. Richardson:

Q. Now I want to make this clear. That when we were discussing the relative quantity of gas contained in 1,000 cubic feet at different pressures, we were not discussing the quantity that the meters would deliver at the various pressures, but we were merely discussing the contents of the gas actually delivered?

A. The relative heating contents at the different pressures. I have a table that I shall put in evidence later to prove up the condition which shows that a service consuming 100 cubic feet of gas an hour at a four ounce pressure would receive gas approximately as follows when the pressure varies:

4 ounces, 100 cubic feet per hour.
3 ounces, 86 cubic feet per hour.
2 ounces, 71 cubic feet per hour.

1 ounce, 50 cubic feet per hour.

Q. Do you know whether or not that is approximately correct?

A. It is.

Q. Now if one man burns gas at a four ounce pressure for one hour, and another man burns gas at a three ounce pressure for one hour, the first man then, his meter would have registered 100 cubic feet of gas, and that is all that he would have burned, is it?

A. Correct.

Q. And the second man's meter would have only registered 86 [fol. 83] cubic feet of gas and that is all he would have burned?

A. Correct.

Q. And that is all he could have burned?

A. Yes, that is all he could have burned. He may not have burned it all, he may have wasted a great deal of it.

Q. We will assume that he burned it. And at two ounces for the same period of time his meter would read 71 cubic feet?

A. Correct.

Q. And at one ounce it would register 50 cubic feet?

A. Correct.

Q. This has no relation to what quantity of gas a man gets in a 1,000 cubic feet of gas at a certain pressure, but is the amount that actually passes through his meter and he does have within a given time?

A. Correct.

Q. In the first instance, the quantity was constant, and the pressure varied, while here the quantity is inconstant, the pressure varies, and only the time is constant, is that right?

A. Correct.

Q. And this man who gets gas at a three ounce pressure and in one hour his meter only registers 86 cubic feet, he is only charged with 86 cubic feet?

A. Correct.

Q. And what would be the difference in that 86 cubic feet if it had been delivered to him at a four ounce pressure instead of three ounces? Less than one and one half per cent is it not?

A. It is less than that. It is about four tenths of one per cent difference (.4%).

Q. As it is, his meter only registered 86 cubic feet?

A. Yes sir.

Q. And that is all that he is charged with?

[fol. 84] A. Correct.

Q. And in the case of the man who received his gas at two ounce pressure, receiving 71 cubic feet, and the man who received his gas at 1 ounce, receiving 50 cubic feet, that is all that he was charged with?

A. Correct.

Q. In other words, while the difference in 1,000 cubic feet of gas at different pressures ranges from zero at atmospheric pressure to 17 at four ounce pressure, yet, as a matter of fact, the meter delivers the gas more slowly at the lower pressures?

A. Correct.

Q. And the meter only registers that which is delivered, and that is all that is charged for?

A. Correct.

Commissioner Russell. Those answers are made on the theory that the condition of the valve is not changed as the pressure is changed, are they not? You are making those answers on the theory that the valve is just the same and is not changed while the pressure changes, is that it?

A. It is the pressure condition in the service line. Changing the position of the valves is merely cutting down the pressure on one side.

Commissioner Russell. If they are opened, instead of getting 100 feet, when you open them wide up you get 200 feet?

A. There is not two hundred feet registered unless two hundred feet of gas has gone through the valves.

Commissioner Russell. I don't say that it didn't go through, but the registration is there.

Mr. Richardson.

Q. In the matter about which we have just been talking, every-[fol. 85] thing is constant except the pressure is it not?

A. Correct.

Q. The meters are the same, all adjusted the same, the size of the pipes are the same, and the time is the same, but the pressure varies. One at four ounces, one at three ounces, one at two ounces, and one at one ounce, and they deliver those different quantities of gas, is that true?

A. Correct.

Q. Now I want to ask you to state to the Commission whether or not there is any other public business where the efficiency of the service rendered depends so much upon what the consumer himself does?

A. There is none.

Q. Explain to the Commission why?

A. That subject has been covered in the statement just prepared for the Bureau of Mines, which is as follows:

"Our service is radically different from every other kind of public utility service in that the gas can not be used by the consumer as received, but,

First. Must be mixed in proper proportion with another substance (atmospheric air);

Second. This mixture must then be completely burned;

Third. The flame must be so directed that the heat generated will effectively get into the food, air, water, or mantle that is being heated, with a minimum loss.

The results obtained will depend primarily on the gas utilization appliance and the consumer's skill and care in operating. All these operating features are beyond the gas company's control, but are

vital in determining the quality of the service produced by one con-
[fol. 86] sumer and the effect on the service of other consumers."

For instance, to take an extreme case, which, however, represents a typical operating situation, the consumer has been used to cooking with gas at four ounce pressure. The consumer has been educated to the belief that he is not getting gas service unless he hears the gas hiss or roar through the mixer. In that same cooking stove with a low pressure condition in the distributing system, the gas is used at one half ounce pressure. The consumer is trying to make a short flame three quarters of an inch long reach to the vessel placed three inches away. For instance, the pencil which I am holding in my hand represents the length of the flame in the ordinary wasteful natural gas cooking stove. The rubber on this pencil is the only effective part of the flame. Now at four ounce pressure with the vessel placed above so that the tip of the flame barely goes to the bottom of the vessel you are getting good efficient operating conditions. However, this efficient operating condition comes from the use of the heat generated at the top of the flame. The heat generated from the top of the burner which is represented by my thumb, to the base of the metal on the pencil which represents the ineffective part of the flame can go out horizontally and downward, but does not go up into the vessel. If, now, during low pressure periods, instead of a flame two and three quarters of an inch long we have a flame three quarters of an inch long, we have the same hot point of the flame, but if we keep our vessel two and three quarters of an inch away you can easily see the difficulty in attempting to heat the vessel with a two inch space between the tip of the short flame and the bottom of the vessel. However, the generation of heat in the flame is efficient. The difficulty comes in the mis-application
[fol. 87] If now, you will lower the vessel, or raise the burner, so that the short flame can get at the vessel, you will get efficient operating conditions, and the gas consumption will actually be less when cooking with a number of short flames three quarters of an inch long, providing the vessel is properly placed, at pressure in the neighborhood of one and one half ounces than with the long flames two and three quarters, or three inches long with the vessel in the usual position.

Q In addition to that, the size of the pipes which run from the curb into the people's houses, and the size of the pipes which they use in their houses are also matters beyond the control of the gas company, are they not?

A They are.

Q In view of the questions that have been asked you by the Commissioner, I want to ask you this question. If a Natural Gas Company, in Oklahoma City should employ and keep a natural gas efficiency expert at its own expense and advertise in the papers that it has one, and that his services are free to the gas consuming public and should also carry on practical demonstrations of the efficiency of gas at various pressures, and of the means of utilizing the efficiency of gas at various pressures, should carry on those demonstra-

tions at public places, should advertise to the public that they were being held, should request the public to come and see them in order that they might ascertain how to adjust their appliances so as to utilize the gas at those pressures and in order that the public might ascertain what sort of appliances to use, and the public would not attend those, would you say that the Gas Company was negligent in its endeavor to educate the public in the use of those appliances, [fol. 88] and in the proper method of adjusting the appliances they had, and in the efficient use of gas at low pressure?

Mr Fulton: I don't think that question could be competent, under any theory.

Mr Richardson: Commissioner Russell asked that question, and I am just laying that as a foundation.

Commissioner Walker: I think the point he made there was whether the average house wife could make the adjustment. The pressure here varies from one ounce to eight ounces, and in order to keep the stoves regulated where they would effectively use the gas at all times it would probably require six to eight adjustments.

Mr Richardson: I am glad you suggested that question.

Commissioner Walker: I think that was the point he was making.

Q. Do you know at what pressure gas is used at Kansas City?

A. It is distributed at less than two ounces per square inch measured pressure at the low side of the regulator, so that the pressure at the consumer's premises is about two inches of water pressure, which would be the equivalent of a little over one ounce.

Q. Then the gas is furnished in Kansas City, you say, at about one ounce pressure from one to two ounces?

A. Correct.

Q. That gas is furnished by the Kansas N...ral Gas Company, is it not?

A. It is.

Q. A year or two ago they had quite a gas shortage there and it was a matter of considerable contention between the gas company and the people, was it not?

[fol. 89] A. It was.

Q. Do you know whether or not they are getting efficient service at a gas pressure in the homes ranging from one to two ounces, at this time?

A. They are getting very much better service than they did at the higher pressure.

Q. Have you made an investigation of the subject lately?

A. I made a personal investigation when I was chief of the natural gas department of the fuel administration.

Q. You say you were Chief of the Natural Gas Department of the United states Fuel Administration?

A. I was.

Q. And you say you made a personal investigation then?

A. I did.

Q. Have you had occasion to inquire or examine into the subject since that time, lately?

A. I have.

Q. State what the facts are in Kansas City with respect to that feature?

A. The entire city of Kansas City is operated on a basis of practically uniform pressure, with a pressure that is very much lower than ordinary natural gas companies carry. The uniformity is due to the fact that they have a conservation rate. That is, they have made the gas worth saving, and by so doing they have greatly curtailed the consumption. The rate is eighty cents per thousand cubic feet, or was the last time I heard of it, and as a result of the lower consumption the consumers' bills have not materially changed. That is the increased efficiency obtained by carrying a lower pressure and [fol 90] using the gas efficiently has enabled the consumer to pay the higher price without an increased annual cost. The result of the whole situation is that they are getting substantially satisfactory service and getting it on what is relatively, from a natural gas viewpoint, a very low pressure.

Commissioner Walker: Right along that line, there are not nearly as many people depending on gas for heating purposes as there were before?

A. In Kansas City, no, because of the rate. The truth of the matter is they do not burn it in furnaces at all. They are not supposed to.

Commissioner Walker: The main part of gas used in Kansas City is used for cooking and lighting?

A. For cooking and lighting, hot water tanks, and incidentals, like small stoves in bath rooms, or bed rooms.

Mr. Richardson:

Q. I believe you made a statement to me in regard to the situation in your own home as to how you had arranged it, and the amount of heat you required, and the amount of gas you consumed. Would you have any objection to making that statement to the Commission?

A. I have a nine room brick house, standing in an exposed condition where the wind has a clean sweep on two sides of the house for a distance of five miles, out in the country.

Q. In what state?

A. Columbus, Ohio. For heating, I have a specially built natural gas furnace. A furnace that in ordinary days gives 80 per cent service. That is, eighty per cent of the heat stored in the gas was delivered in the heated area. I use the natural gas for cooking, in an ordinary natural gas range that has had the burners raised. That is, the old burners were three and a quarter inches below the [fol 91] vessel's bottom. Those burners have been raised until that distance is cut down to one and a quarter inches. I am using the gas under a hot water heater, ordinary horse-shoe burner under the tank, with a galvanized iron jacket two inches larger in diameter than the tank on the outside with a tight head at the top of the jacket above the tank, and a flue connection at that point. The

efficiency of that simple hot water heating arrangement is so high that I get out all of the latent heat in the combustion products in the gas from this hot water heater or tank where they leave to go in the chimney are under 200 degrees Fahrenheit. We burn all garbage in a gas fire incinerator. Have never owned a trash can. All laundry work is done in the house with colored help; a one room garage is also heated. The average gas bill for the year with .30 cent gas has been $80.00 a year for all that service.

Q. Winter, summer, and all the time?

A. Yes.

Q. At what pressure do you consume gas in your house?

A. At about two ounces. In fact I have regulators on the cook stove so that nothing but low pressure gas can be used in the cook stove.

Q. It makes no difference at what pressure the Company puts the gas in the pipe in the line, when it comes to your stove it cannot go in there at over two ounces?

A. Correct.

Commissioner Walker. That is a question that occurred a while ago. They would have to install equipment in addition to the adjustment of the stoves. They would have to have other equipment on them?

A. No sir, that is merely a matter of convenience. We can show you that it depends on the manner of using the gas, and it can be [fol. 92] done without the use of the regulators, but that merely eliminates the necessity of watching it. If you have proper regulators on and always carry only low pressure you are doing one other thing which is of interest. You are cutting down the leakage in your house piping and making it unnecessary to add those individual touches on the gas cocks, but you could burn one pound pressure in a cook stove and efficiently cook, if you only partially open the cock.

Mr. Richardson. You say one pound, do you mean water pressure?

A. I mean one pound per square inch, sixteen ounces. That is if the gas company should furnish such high pressure gas nobody would be so foolish as to use it. For instance, if you want to fill a glass of water from the city faucet you would not open the faucet wide. You would not open it wide because it would be wasteful and would throw the water out of the glass. Now apply that same principle to the natural gas.

Q. Have you Bulletin No. 102 of the Smithsonian Institute?

A. I have.

Q. What is the Smithsonian Institute?

A. The Smithsonian Institution is a privately endowed scientifical institution for research in the pure and applied sciences. At an early period in its history it was subsidized by the United States Government. It started out as a privately endowed institution named for Mr. Smithson who originally furnished the money. This is now carried on under the supervision of the United States, jointly. That is, the original investment has been supplemented by Congressional money.

Q. Bulletin 102, Part 7, of the Smithsonian Institute, printed at Washington, by the Government printing offices, in 1918——

[fol. 93] A. Just a moment. Whenever you have used the word Institute in the record, let it be Institution, so as to be accurate.

OFFERS IN EVIDENCE

Mr. Richardson: We wish to offer the text on page 18, as follows: Under the heading "Regeneration:"

"Food and trees can be grown. Water supplies are constantly replenished by nature, but there is no regeneration in natural gas; and when the gas is once used it is gone forever. While no one knows exactly how the natural gas is formed, yet enough facts are known about it to indicate that nature's process was a very slow one. It has taken millions of years to make the present concentrated supplies, and even though gas should now be formed in some parts of the earth's crust, the rate of formation will be so slow as to make such new gas pools of no interest or economic value for centuries, if ever."

Mr. Fulton: Whose statement is that?

Mr. Richardson: It was Mr. Wyer's and I offer it as a part of his testimony. We also offer page 19, under the heading "Storage of natural gas:"

"Storage facilities for natural gas are not commercially feasible in the field nor at the delivering end of the transmission line, except the very limited use of existing gas holders in distributing plants. The large variation in service demands must therefore be met by the wells and reserve acreage. That is, the entire field operations must be subordinated to the peculiar service demands made on the natural gas company. An interesting contrast with these stringent operating conditions is the large storage equipment in acres of tank farms that may be used to equalize the load in the oil industry."

[fol. 94] Mr. Richardson: We also offer the text of portions of pages 21, 22, and 23, under the heading "Scarcity of Natural Gas:"

"Natural gas is an exhaustible resource that when once used is gone forever. Every time a natural gas company sells 1,000 cubic feet of gas it is selling a part of its property. Furthermore, the number of natural gas consumers is increasing faster than the number of producing wells, thus placing an additional burden on each well, and the wells that are being drilled at the present time have a lower average capacity than wells that were drilled several years ago, in this way making less gas available."

Mr. Richardson: We also offer the text on page 23, under the heading, "Natural Gas service is based on a Non-creatable and Non-regenerative Mineral."

"The natural gas business is unique in that it is the only public utility service that does not, and in fact cannot, create the basic feature of the service that it renders to the public. Manufactures gas companies merely produce their gas from the raw fuel that they can buy in the open market; transportation agencies, like railroads or street railways, can easily create the motive source of their service; water utilities have their water supply constantly replenished by nature; intelligence transmission utilities, like the telephone and telegraph, can easily create the primary source of their service. However, the natural gas industry is alone in depending entirely on the caprice of nature for first the finding, and secondly, the continuity of the supply of its primary source of public utility service."

[fol. 95] Mr. Richardson: We also offer that portion of the text found on page 35, and continuing on page 36, under the title "Peak Load Service" as follows:

"Abnormal peaks of very short duration are characteristic of all natural gas loads for domestic consumers. This necessitates a large property value for equipment that is actually used only a very short period out of each year. Every natural gas company must have considerable equipment that will be used not over four hours daily during say 30 of the coldest days of a year of normal temperature. The smallness of this is evident from the following:

Total number of hours in the year	$24 \times 365 = 8,760 = 100$		per cent
Hours Peak load equipment is actually used	$4 \times 30 = 30 =$	1.4	per cent

Industrial loads are very much more uniform than domestic loads. This is especially true of the carbon black industry in the field, where the load can be made uniform every day of the year. The relationship between maximum, minimum, and average load conditions is shown on page 37.

An increase of volume of business can decrease the cost of production only when the increment of increase is distributed so as to make possible the more efficient use of existing equipment. When the increment of increase is concentrated so as to require more equipment, as is the case in all peak loads, the cost of production to the unit of service is increased. Therefore, the cost of peak load natural gas service is greater than the cost of normal service. A rate schedule, to be equitable to all consumers of natural gas, must make the consumers who need and create the peak load service, pay a price that will be commensurate with the extra cost of the service they are receiving."

[fol. 96] Mr. Richardson: We also offer that portion of the text found on pages 38 and 39, under the heading "Peak Load Conditions Analagous to Strap Hanger Problem:"

"While it would be possible for a street car company to install and operate enough cars during the peak-load period to give every

one a seat, yet the cost of so doing would make the general service cost much more than the additional advantages would be worth. Since the demand for seats may be four or five times as great during the rush hours as it is in the middle of the day, the only feasible way to deal with this situation is to admit the necessity of a different standard of service for rush and nonrush periods. Since the fare remains constant, it becomes necessary to provide relatively fewer cars, and therefore fewer available seats, for the rush period than for the nonrush travel. But for the uniformity of street railway rates, the rush hour passenger might justifiably be charged more than the nonrush passenger. Conversely, it is not unreasonable that he should, paying the same fare, expect to have to put up with a somewhat less comfortable ride at that time. There is certainly little economic ground for an especially reduced fare for this service.

This is precisely the situation with regard to natural gas pressures during the peak load period, with this further feature, that the natural gas peak load periods cover relatively only a few days of the year, as against the everyday situation on street car traffic. As long as natural gas prices for the higher costing peak load service remain the same, the consumer must therefore expect a lower standard of service during that period."

Mr. Richardson. We also offer that portion of the text found on page 40, under the heading, "Use of Auxiliary Heating Appliances:"

[fol. 97] "It is desirable in all cases where possible to have auxiliary heating equipment available for supplementing or entirely replacing for a short period natural gas for house-heating service, during the peak period of the load. Where gas furnaces are used, auxiliary oil burners can be installed in such fire pots, or auxiliary coal furnaces can be installed alongside the gas furnaces, where the coal furnace would discharge its heated air into the gas furnace shell."

Mr. Richardson. Also we offer that portion of page 40, under the heading "Few Improvements in Art of Using Natural Gas."

"On account of the low prices that have prevailed, gas-appliance manufacturers have not been stimulated to the development of efficient gas-using equipment. There have been few improvements resulting in increased efficiency in the last 15 years. In testing house heating furnaces it has been found that:

1. The use of natural gas in the fire pot of a coal furnace gives an efficiency of about 25 per cent.

2. The use of natural gas in the ordinary gas furnace gives an efficiency of about 35 per cent.

3. The use of natural gas in a correctly designed and built gas furnace, where the construction conditions permit the fullest utilization of the heat in the gas, gives an efficiency of about 75 per cent.

In tests made by the Bureau of Standards, it was found that the ordinary incandescent mantle lamp where used with natural gas

wasted nearly half of the possible heat that could be used if such lamps were designed for as efficient operation on the high heating value natural gas as they give on the low heating value manufactured gas.

[fol. 98] In tests made by the department of home economics, Ohio State University, the efficiencies of a natural gas range varied from 37 per cent with 0.2 of an ounce pressure down to 13 per cent at 4 ounce pressure, while with a manufactured gas range, using natural gas, the efficiencies varied from 43 per cent at 0.2 ounce pressure, to 23 per cent at one ounce pressure."

Mr. Richardson: We offer the text found on page 41, under the heading "What is Usable Natural Gas Pressure."

"The pressure carried by most natural gas companies have been too high for efficient service. This has had the further undesirable feature of teaching the consumer to believe that he was not receiving service unless the gas could be heard hissing through the orifice in the gas mixer. It has been demonstrated that

1. Satisfactory cooking operations in frying potatoes, boiling potatoes, frying beefsteak, and pan-broiling beefsteak can be carried on with 0.2 ounce natural gas pressure. This merely requires that the short flame and cooking vessel be brought together. The changes in vessel position necessary to permit satisfactory operation at pressures as low as 0.2 ounce are easy to make, require no special change in existing stoves, and consist merely, with drilled burners, in placing three nails in three of the drilled holes, and, with slotted burners, of placing three small pieces of tin in three of the slots, in order to support the cooking vessel at the proper distance from the burner, and close enough so that the short flame can do effective work.

2. Better results are obtained with pressures in the neighborhood of 2 ounces than at 4 ounces.

[fol. 99] 3. Less gas is used at pressures in the neighborhood of 2 ounces than at 4 or 5 ounces.

4. Manufactured gas range gives better results than natural gas range because the former is designed for low pressures.

5. There is very little difference in the time required to carry on cooking operations with pressures of from 1 to 5 ounces.

Therefore, if the consumer will use proper appliances, satisfactory cooking operations can be carried on with pressures as low as 0.2 ounce and the gas passing through the meter will perform a usable service.

With heating appliances, if the mixer is properly adjusted the combustion at low pressure can be made substantially as thorough as at high pressures, and the consumer can have the benefit of all the heat generated by the burning gas, although if the pressure

is low he will invariably not have nearly as much as he would like to have or as he needs. However, all of the gas measured by the meter and burned in the heating appliance is used for a useful service, so far as it goes, although under extreme low pressure conditions there is not enough to give all consumers all they want."

Mr. Richardson: We also offer that portion of the text on page 42, under the heading "Accuracy of meter registration at low and various gas pressures."

"The popular belief is that meters run faster when the pressure is low than when the pressure is high. This is contrary to the facts. Variation in pressure makes no appreciable difference in the registration of the meter, the meter merely registering, within a reasonable limit of tolerance, the amount of gas that passes, and [fol. 100] this is neither increased nor decreased by changes in pressure."

Mr. Richardson: We also offer that portion of the text found on page 42, under the heading "Gas Meter Facts."

"The following features regarding gas meters should be borne in mind:

1. Gas meters have no power within themselves to register. The only way they can be made to register is by the passage of gas through the meter. The gas company has absolutely nothing to do with the operation, nor can it in any way control the registration of the meter. However, many times gas meters register when gas is not being used, due to leakage in house fixtures.

2. The gas consumption will not be increased by the use of a large meter.

3. The gas consumption will not be decreased by the use of a small meter. In fact, if the meter is too small the gas service will be unsatisfactory.

4. Gas bills are not made out regardless of gas consumption. While it is possible for the meter reader to make an error for one month, this will be automatically rectified in the reading of the following month.

5. High gas pressure does not increase or decrease the rate of registration of meter.

6. Low gas pressure does not increase or decrease the rate of registration of the gas meter.

7. It is impossible for a gas meter to register twice. When the gas has passed through the meter it cannot pass through the second time.

8. Meters do not always register fast. There are just as many times when they register slow, and this is to the detriment of the [fol. 101] gas company."

Commissioner Walker. I don't think there are very many cases where they register slow, Judge.

Mr. Richardson. No, I don't think so.

Commissioner Walker. I was just thinking about Dr. Wyer's comparison of the gas peak load with the strap-hanger on the street car. It occurred to me that the only time it would be comparable would be when you are on the street car one of these cold snowy days and after the conductor had rung up your nickle you had to get off and walk, because the ordinary strap-hanger gets home, but the gas gives out.

Mr. Richardson. We offer that portion of pages 44 and 45, under the heading of "Effect of pressure on temperature changes on heating value of gas", together with the table there found:

"These will produce changes in volume, but will neither destroy nor create any heat units, and hence will neither increase nor decrease the total number of heat units contained in the gas. However, the volumetric changes will always alter the distribution of the total number of heat units, as follows:

Gas pressure above atmosphere	British thermal unit	Relative per cent
8	1.034	103.4
7	1.030	103
6	1.026	102.6
5	1.022	102.2
4	1.017	101.7
3	1.013	101.3
2	1.009	100.9
1	1.005 (1.005)	100.5
0	1.000	100

[fol. 102]

Gas temperature, °F	Relative British thermal unit	Relative per cent
70	960	96
65	970	97
60	980	98
55	990	99
50	1.000	100
45	1.010	101
40	1.020	102
35	1.030	103

Commissioner Russell. What we want is some condition powders for our stoves that will make them digest the gas as it goes by.

Mr. Richardson. We also offer in evidence that portion of pages 48 and 49 under the heading "Why standards for natural gas service must be lower than for manufactured gas."

"The operating conditions in a natural gas plant are so different from those prevailing in a manufactured gas plant that the standards

of service that would reasonably be applicable to the latter would not be feasible or expedient with natural gas, because:

1. The volume of natural gas business for each domestic consumer is generally about five times as large as for manufactured gas.

2. The peak load difficulties in a natural gas load are much more troublesome than in manufactured gas, due primarily to the heating load, which fluctuates with the atmospheric temperature.

3. The service standards cannot be limited to merely the distributing plant limits, but would be closely related to the main pipe lines, back into the field to the compressing stations, and general field operating conditions.

[fol. 103] 4. The natural gas company cannot create the basic feature of the service it is selling to the public, but must depend entirely on the caprice of nature for this.

5. Every foot of gas sold represents in effect the sale of a part of the company's property.

6. Since there is no regeneration, the supply can be kept continuous only by constant and persistent hunting for new supplies.

7. Although the distributing end is a public utility service, the field or producing end is a mining proposition, and the continuous connection of the two by the transmission line has the immediate effect of also connecting the mining hazards to the distributing end of the business.

8. The migratory tendencies and fugitive nature of natural gas under the ground make its reduction to possession much more difficult than for solid minerals.

9. In general, the prices for natural gas service have not been adequate, and have not been made on the basis of rendering as uniform a condition of service, especially with regard to pressure as can be maintained in a manufactured gas plant.

10. Both the quality and quantity are controlled by nature."

Mr. Richardson: We also offer that portion of the text beginning on page 49, and continuing on to page 50, under the heading "Discount for lower pressures stimulates waste."

"A penalty clause providing for a discount when pressures less than four ounces are maintained has been suggested as a means of guaranteeing good service. However, instead of guaranteeing service it stimulates waste for the reasons given on page 54. The penalty [fol. 104] clause is inequitable and fails to recognize the well known operating characteristics of the mining, transmission, and distribution of natural gas, which, therefore, differentiates this from every other type of public utility service, more particularly by:

1. Failure to recognize that the heating value of the gas does not decrease proportionately with the decrease in gage pressure.

2. Failure to recognize that neither the efficiency nor the efficacy of gas decreases proportionately with the decrease in gage pressure.

3. Failure to recognize that higher efficiencies may be obtained at pressures below 4 ounces than at 4 ounces and above.

4. By ignoring rate of flow or volume of gas to be delivered and the close relationship that exists between volumetric demands and the constantly changing and uncertain and unpredeterminable atmospheric temperature changes.

5. General conservation methods in the field have not been followed in the past; gas has been produced, transmitted, and distributed in a most wasteful manner, which has, therefore, very greatly depleted available supplies, highly desirable for peak-load service.

6. The uncertain, migratory, and fugitive nature of the gas in the underground reservoirs, where it is entirely *ebyond* the control of the human will, legal process, or contractual relationship, and yet where its expansive properties under the ground must be taken as the initial step for the delivering of service to consumers 200 miles away, obviously makes it evident that considerable leeway must be allowed in service standards."

[fol 105] Mr. Richardson: Now if the Commission pleases, I think we are ready for the demonstration, and I will pass from this with the privilege of returning to it later on, and will ask Mr. Wyer to explain to the Commission what the nature of the demonstration will be, and the facts in regard to it before we go down there.

By Mr. Wyer (the witness): It will be preferable to do that downstairs where I can do that with the apparatus. We will have a photographer present to make photographs of it, and will get a good description of the apparatus and in that way can make a complete story in the record.

Commissioner Walker: Do you want this demonstration to be a part of the record?

Mr. Richardson: Yes sir, as far as we can make it a part of the record. We have not examined Miss Ehfritz yet, and I wanted her to testify as to what her business is.

Commissioner Walker: I think she would make a better witness there, than here. We will adjourn to the dining room of the building for the demonstration.

Duly convened, in the dining room, the Commission, counsel, witnesses, and spectators present.

By Mr. Wyer: The apparatus that is before you consists merely of two natural gas stoves, and an ordinary meter such as is used in the ordinary domestic consumer's premises, with however, a special dial reading to one one-hundredth (.01) of a cubic foot, and in order to record the pressures we are using, an ordinary U tube pressure guage has been installed. The letter "A" represents a Globe valve controlling the supply of gas coming to the equipment.

[fol. 106] The letter "B" indicates the meter used in measuring the gas going to the two stoves. The letter "C" indicates the "U" type water pressure guage which measures the pressure of the gas immediately adjacent to the appliance, in inches of water, and for comparative purposes it may be stated that one ounce per square inch of pressure is the equivalent of 1.73 inches of water pressure. The letter "D" represents an ordinary natural gas range which, however has two features that are very desirable, first, it has a grid top instead of the ordinary solid top, and second, the burners on this stove are very much nearer to the bottom of the vessel than on the ordinary natural gas stove generally used in natural gas towns. The letter "E" represents a typical natural gas stove. This stove has a solid top, low burners, that is, the burners are about three inches below the position of the vessel when the vessel is on top of the stove. The stove "E" is grossly inefficient, and is responsible for a great many of the complaints that come in from inadequate service, and yet this is the type of stove construction that is represented by more than 95% of the natural gas stoves in use. The stove "D" is a stove that is much more efficient and will give very much better service under low pressure conditions, with a smaller gas consumption, because the manufacturer has recognized the fundamental requirements developed in the tests of the Home Economics Department of the Ohio State University, namely, that the vessel's position must be such that the flame can get to the bottom of the vessel, and that better results can be obtained with low pressure and a properly directed short flame, than with the high pressure of three or four ounces, and the usual long flame.

Mr. Richardson. Miss Ehfritz, you have been sworn, have you?

[fol. 107] Miss Ehfritz. I have.

Questions by Mr. Richardson:

Q. Your name is Miss Olga Ehfritz?

A. It is.

Q. Where do you live?

A. My home is in Toledo, Ohio.

Q. In what business are you now engaged?

A. I have been with—from the time I left the Ohio State University until last August, I have been engaged in extension work for the Ohio State University.

Q. In what department?

A. The Home Economics Department. At that time I entered the service of the Eastern Oil Company to effect the use of low pressure gas, and gas conservation in the towns of West Virginia, and Maryland, which that oil company supplies with gas. I have been retained, however, by the Bureau of Mines, to start the gas conservation work in Dallas, Texas, and which is to be taken up throughout the state of Texas by such agencies as they have at their command.

Q. As I understand you, then, you are now in the service of the United States Bureau of Mines?

A. I am retained merely to start that work. Their program has not been started to any great extent, as yet.

Q. Will you state how you come to be here?

A. I received a wire from Director Manning, of the Bureau of Mines, to appear before the Oklahoma Utilities Commission to show the use of low pressure gas, as well as conservation methods.

Q. Now then with that statement, you may proceed to make your demonstration and any explanation that you may desire to make. [fol. 108] A. The greatest waste and the most dissatisfaction has come from three factors,—for the house wife I am speaking.

First the house-wife has never been taught how to use natural gas. As we know, it is the only utility which is delivered to use, in a state in which we cannot use it. It must first be mixed with something, then it must be burned correctly, and the heat derived directed correctly. The second point is inefficient appliances, and the third, I may say, comes from dirty appliances. In the first place, every cubic foot of gas we burn must be mixed with nine and one half cubic feet of air in order to have perfect combustion. In order to recognize perfect combustion in a cooking stove, we should see a greenish blue flame, not a yellow flame, and not a red flame. The greenish blue flame indicates perfect combustion. The nine and a half cubic feet of air is not in the gas, but it comes through the opening in front of the burner which is known as a mixer. It is on all stoves such as kitchen ranges and kitchen stoves. This is the mixer (indicating) or it may be termed the shutter which allows the air to flow through and be mixed with the gas. The second place where the air is mixed with the gas is where it comes through the openings in the top of the burner. If the mixer is closed, that eliminates the greatest source of air, and you will have a smoky luminous flame, very inefficient, as well as wasteful. As shown upon the stove "D" you have a closed mixer, and a luminous smoky flame (indicating by lighting burner). With the same gas on the same stove, "D" with the mixer wide open, you will have the greenish blue flame (indicating by lighting another burner on same stove). That is the use of the mixer. Simply a sort of air chamber through which the air flows. Within [fol. 109] this air mixer, there is what we know as a spud, or gas projector. There are two types. The one which is known as the adjustable type, because you adjust the size of the opening through which the gas flows, by the use of a wrench. The second type is a stationery type which is within the mixer at the end of the valve. There you will find, on the other type of stove, a stationery spud. That cannot be regulated with a wrench. This gas projector is really to increase the speed, I might say, of the gas so there is a sucking, or aspirating force through the mixer by which the air is drawn in. A very simple illustration is the air nozzle, which goes sixty miles an hour and sucks or draws everything in after it. The speed of the gas is increased in that way so as to suck the air in. As I have said, the air is not in the gas, but must be pulled through the mixer in order to have your blue flame. After you have a perfect flame, I may say a perfect

mixture of air and gas and so burning it, the second thing to consider is the application or the direction of this heat which you have and are having formed in the burning of this gas. This brings us down to the inefficient appliances in which natural gas is being used today. The inefficient appliance which I have my hand on now, the gas range "E" has the burners three inches from the top of the stove. When the pressure is low it is absolutely impossible to cook on top of this stove, and especially so through the solid top. It cannot be done with extremely low pressure with the burners at that distance. In order to cook any time on a range such as this stove type "E" you have to have a flame three inches long so that the tip of the flame will reach the bottom of the vessel. If this stove were arranged, or really built efficiently, I could cook the same meal with the pressure any where from an inch and a quarter to an inch and an eighth, and instead [fol. 110] of using only 13 per cent of the gas which is going through the meter I would be able to use 43 per cent of it. This is the general type of natural gas range. In order to make this range efficient, in order to be able to use the low pressure gas, and in order to conserve gas at all times, whether the Company carries ten ounces pressure or a sixteen ounce pressure, you can save large quantities of gas, and what you don't use today, what you don't use tomorrow will be simply storing that up to a certain extent, for a future day. If you used a stove which has the burners five inches down, and used it with an eight ounce pressure and the valve wide open, you are mortgaging your future supply of natural gas and bringing closer the day when you will use artificial gas with one half the heating qualities of natural gas, and for which you will pay not less than $1.25 per thousand cubic feet. To increase the efficiency of this range "E" the burners should either be raised, or the vessel lowered. The burners should be raised to within one eighth, or one quarter of an inch from the top and be fixed permanently. To lower the vessel we merely use four nails which will bring the vessel to within three quarters, or an inch above the top of the burner, and in that way we will be able to cook absolutely any food, even though the pressure goes as low as three tenths (.3) inches of water. The second point in making this stove more efficient, is to absolutely eliminate the solid top. It is a very useless, expensive, wasteful process to use a solid top at any time. The only thing that you do is to heat a quarter of an inch of iron, and that iron radiates the heat, or transmits it into your cooking vessel. The most efficient way, and the most saving way is for the heat to go directly into the vessel. The [fol. 111] third adjustment which may be used is to increase the size of the opening in this air projector, or orifice through which the gas flows, from the size of a pin point to a larger size. That is, to put it on an artificial gas range basis (at this point witness lights another burner on range "D"). Now that is the way, on this range "D" in which the majority of houses we have, burn their gas. At four ounce pressure, blowing. That is the gas

which goes through the openings burning. This is the size of the opening, and the size of the blaze you have before your gas range is regulated, which you should do, or know how to do, and do it yourself. The flame from the burner which has been regulated, is at least one inch long. The one which has not been regulated, is not more than a quarter of an inch long, which shows the desirability of regulating your own burners. Having a wrench on hand. This also shows the undesirability of having the valve wide open (here witness opens valve, and blaze from burner makes roaring sound, and some of the holes apparently not burning, but blown out). Now when you hear that blowing, roaring sound you see only about one half of the holes are lighted. This one, again, (indicating another burner) shows the smoky flame which occurs when the air shutter is absolutely closed. And this also shows the condition existing when the orifice of this gas projector is open too wide. When that hole is so large within the mixer that the gas merely flows through, there is not enough air sucked through to form perfect combustion and we have a smoky luminous flame. I will show you the condition on the ordinary natural gas stove. That is the height of the flame which is used on this type of range, "E". The inefficient natural gas stove which has been used and is used today in practically all of the homes. This is at four ounce pressure. The flame on the [fol. 112] gas range "E" which is adjusted at three tenths inch of water, with a flame very nearly one half inch long, it will be absolutely impossible to cook anything with that pressure on top of this stove. Through either the solid top or the grid top. By using four nails and removing the top of the stove you can cook practically anything on that size flame if you will bring the vessel down to the tip of that flame, supporting it on four nails.

By a lady in the audience. How do you place those nails?

A. At regular intervals around, just so they will support the vessel. They are merely stuck down in the holes in the burner. If the nails are not the right length, clip them off so that when they are in solidly they will be from a half an inch to three quarters of an inch above the surface of the burner. If the burner is of the slotted type use triangular pieces of heavy tin at equal intervals. Four will support any ordinary size vessel. The tip of that flame is spreading so I will have to cut it down. So at the valve I will cut it down from three tenths of an inch water pressure, to less than that, which will mean that on this burner, or under the skillet I am burning now probably not more than one tenth of an ounce of gas pressure at that point, and as you see, and can see, that skillet is smoking. To prove to you that I can cook I am going to let some lard get hot in that skillet. The skillet is not even, and the nails are slightly unlevel. You can see the grease smoking and will be able presently to detect the odor of it. (Here witness breaks an egg into the skillet, holding the egg high enough so that when it fell into the skillet the yolk broke and the egg began to fry.) Now the tip of that flame is just touching the bottom of

[fol 113] the skillet. If you care to, you may look in here and see that I am utilizing the tip of that flame, only.

By a lady in the audience: Could you have fried that egg without breaking it. It would have taken longer.

A I can try it if you wish. It was a question of the condition of the fat in the skillet, and not the condition of the egg. If you care to, you can see the height of the flame that was used. It was cut down to less than one half an inch, not more than a quarter of an inch. Now as far as the third point considered, it is a very simply thing, and yet I mention it as one that is usually neglected. That of the dirty burner.

Mr. Richardson: Before you pass to that, I would like to ask you a question. Could you fry beefsteak on that flame?

A I think I could.

Q Have you ever done it on a flame no higher than that?

A I have done it, but not on a flame that low. That is the condition of the fat, and the condition of the steak. Whether you want it rare, or done.

Q You had no more than one tenth of an ounce pressure there.

A Not more than that.

Q Could you fry beefsteak at one half ounce pressure?

A You could burn it.

Q Could you boil water at one tenth ounce pressure if you set the vessel down where you had the other?

A I can.

By a lady in the audience: How long would it have to be there in order to do that?

A When your gas pressure is down to one tenth of an ounce pressure, the water is down very close to the 32 degree point. Cold [fol 114] water which comes through your faucet is very, very cold when your gas pressure is down. That all has to be taken into consideration. Are there any other questions before I go to the last, that is, the proper pressure?

Mr. Wyer: If you want the record to show about the beefsteak, I can say that I have watched a number of pan-broiling operations with the water pressure down to three tenths of an inch, but with the gas cocks wide open. You will note that in frying or cooking, although the pressure at the stove was three tenths of an inch only a part of that extremely low pressure was applied to the cooking operation. Therefore, there is no question but that it is entirely feasible to fry, or pan-broil beefsteak with a pressure as low as fifteen hundredths of an ounce (.15).

Mr. Richardson: Miss Elfritz, when you spoke about the gas being reduced to such pressure as you have there that the temperature of the water was also very low, you mean that the gas pressure is so reduced only in periods of extreme cold weather did you?

A Yes sir.

Q And that in periods of extreme cold weather the temperature of the water is also very low. So that in order to boil the water, the gas would have more work to perform than it would have if the temperature of the water was what it is in normal weather?

A Yes sir.

Q Because it is colder, it would take longer?

A Yes sir. Are there any other questions?

Commissioner Russell What is the ordinary pressure ordinarily used in this town in the ordinary stove in cooking, if you know? [fol 115] A I cannot answer that. You will have to ask the manager of the Gas Company that question. He will probably be able to produce his records. I have no information as to what pressures are available here.

Mr Fulton What is the difference between the amount of heat that you would obtain from the high flame before you adjusted it and the way you have it now?

A The heat is just the same. That is the same gas, whether I have it here, or down here.

Mr Fulton In other words, you get as much heat from the small flame as the high flame?

A It is all the same so far as this one experiment is concerned. It is the direct application of the heat.

A voice May I ask what have you to suggest to remedy these ordinary evils in imperfect stoves?

A Either the raising of the burners which is a permanent thing, and which should be followed, but may I suggest the temporary remedy of using the nails removing the top of the stove entirely if grid tops such as are used on stove "D" cannot be obtained, and being sure that your appliance is absolutely clean. With every 1,000 cubic feet of gas which you burn you have mixed with that, and you have to mix with it in order to have perfect combustion, nine and one half thousand cubic feet of air. You thus have about ten and one half gallons of water formed in the shape of steam. It is not in the gas. It is in the combustion product. That is one of the products when you burn gas. If you are not careful, that condenses in your burner, and it is something that cannot be helped, but it can be eliminated by removing your burners and shaking them out and cleaning them out. These burners should be removed at least once a month and boiled [fol 116] out and thoroughly cleansed. The rust removed and the encrustings of dirt removed. That will aid in taking air and in producing a perfect flame.

By a voice What do you put in the water when you boil the burners?

A Either straight soap suds, or with a couple of gallons of water probably half a cup of washing soda. Now this is one burner which I have shaken out and have stirred up the rust which was in that burner. When those rust particles are burned out, then the flame will be more perfect. This flame also shows the condition of some of the stopped-up holes which you will find on the various stoves.

cooking stoves as you will investigate them. The three fundamentals then which must be considered in taking care of low gas pressure and using low gas pressure at all times and thereby conserving a great quantity of the gas which is going to waste throughout this country, we must consider first, the proper using of our gas, second, having our appliances made efficient, and finally, taking care of these efficient appliances. If there are any questions I shall be glad to answer them.

Commissioner Walker: What is the highest pressure of gas which should be used in that stove?

A. With efficient appliances, and with the flame properly directed, I would say you can cook a satisfactory meal with two ounce pressure.

Commissioner Walker: For all purposes?

A. Yes sir.

Mr. J. F. Owen: May I make a statement here, not for the record.

Miss Ehlfritz: May I make one statement more, and that is, what-[fol. 117] ever the pressure is, that you get in your homes, you can get satisfactory results in using the lower pressure by regulating it here at the valve, by having a thermostat on your furnace. These two features will take care of that part of it no matter what pressure your gas company carries, but you would not be able to use a two ounce pressure with your valve wide open even with your stove if you have the raised burners, so thereby you are conserving a large amount of gas, and that is what we are aiming for at the present time.

Mr. Richardson: Miss Ehlfritz, you said they would not be able to use a two ounce pressure. You mean that would be excessive?

A. Yes, because it would flare up around the vessel and since the tip of the flame is the hottest part and we want that directed on the bottom of the vessel. That will be our aim in using the short flame directed on the bottom of the vessel.

By a lady in the audience: In a stove furnished like that, how about baking. How can we arrange our stoves so that we can bake with them. That is our greatest trouble.

A. You cannot bake with one tenth ounce gas pressure.

Q. Is this oven constructed for low pressure, here?

A. I have baked with one and a half ounces, or with 15 ounces of gas, but that was with a very efficient oven, and that brings us back to the appliance end of it again. Most of the ovens are inefficient, and may I say that the one reason for the inefficient appliances of all the natural gas appliance, is naturally caused, or has [fol. 118] been practically caused for so many years there has never been any effort or force brought to bear with the stove manufacturers until the present time, when the gas supply is running short from one end of the United States to the other. It is only recently I am sure of that.

By a voice: Are there any makes of stoves at the present time which carry those efficient appliances?

A. There are some which I know of that are efficient.

Mr. Richardson: Will a two ounce pressure furnish adequate pressure for baking?

A. Yes sir.

Q. In a stove that is only ordinarily efficient?

A. Yes sir.

Q. Would a two ounce pressure furnish adequate pressure for baking in a stove like the stove marked Exhibit "E"?

A. I feel sure it would.

Q. Would one and one half ounces pressure in a stove ordinarily efficient, provide adequate pressure for baking?

A. I feel that it would.

By Mr. Owen: I want to say that the efficiency department of the Oklahoma Gas & Electric Company is prepared, and we have advertised this fact thoroughly, prepared to make tests of any make of stove and the result of those tests as regards their efficiency, and the result of those tests are yours for the asking. Furthermore, we maintain an efficiency department for the purpose of giving in your home, a demonstration of what can be done and should be done in the matter of regulating stoves to meet low pressure conditions, and furnaces as well. The information of those experts is yours for the asking. We maintain that department at quite considerable expense, without any cost to you, and our only difficulty in maintain-[fol. 119] ing the department, regardless of our advertising, is that people have not availed themselves of it. This man is ready to go to your home and show what improvement is necessary or should be made in your furnaces or other gas burning appliances so the most economical and efficient results can be obtained.

By a lady in the audience: How do they manage to get that thermometer put on the meter there so as to get a certain amount?

Mr. Richardson: That is just to show the amount of gas used in this test.

By a lady in the audience: She spoke about a thermostat, who sells those?

Mr. Richardson: The Oklahoma Gas & Electric Company will do that. Is that all here, Mr. Wyer?

Mr. Wyer: I would like to give a brief summary of the whole gas conservation program that has been initiated by Secretary Lane of the Department of the Interior, and which will be directed and promoted by the Bureau of Mines. I will give that upstairs.

(Thereupon no further proceedings or demonstration is had in the dining room, and the further taking of testimony is to be resumed in the Court room of the Commission.)

Duly convened in the Court room, the parties all present as at the time of recess from the dining room.

Mr. SAMUEL S. WYER resumes the stand for further examination.

By Mr. Richardson:

Q. You may proceed with the statement you had started down stairs following the demonstration?

A. The natural gas conservation program which has been initiated [fol. 120] by Secretary Lane of the Interior Department, and which will be promoted by the Bureau of Mines, is intended to cover all of the natural gas using states. It is primarily an educational program to teach the user how to get the most out of the natural gas. At the present time the ordinary domestic consumer wastes more than 80 per cent of the gas received. That is, for each dollar's worth of gas received and paid for by the average domestic consumer, eighty cents worth is thrown away. The application of the conservation principles that have been laid down as far as gas utilized in the home is concerned, will result in three outstanding facts.

First. It will make one foot of gas do the work of three; that is, the ordinary domestic consumer can get the same cooking, heating, and lighting service with one third of the gas, which would mean that if 90 cents were charged for gas with proper utilization the annual cost to the consumer for a year's service would be no more than where 30 cents is now charged with ordinary inefficient utilization.

Second. The conservation program will enable the user to get usable service under low pressure conditions, which of course are now, and will continue to be inevitable during extreme cold weather in winter.

Third. This program will add from fifteen to twenty years to the available use of natural gas for the present domestic consumers. In view of the fact that the average price of manufactured gas is probably away in excess of $1.25 per thousand cubic feet, and on which comparative basis, natural gas, because of its double heating value, would be worth $2.50 per thousand cubic feet, it is obvious that natural gas is worth conserving, and delay- [fol. 121] ing the day, which of course is ultimately inevitable, when the domestic consumer must go back to the more expensive manufactured gas, is of some economic significance and interest to every one of the two million four hundred thousand domestic natural gas consumers in the United States.

Q. Is that all the statement you have to make?

A. Yes.

Q. Mr. Wyer, do you know how it would be possible to procure the Bureau of Mines to carry on an educational campaign of that kind in Oklahoma?

A. If the proper state officials will immediately communicate with Mr. Manning, the Director of the Bureau, I am quite sure

that arrangements can be made at an early date for carrying on the natural gas conservation program in the entire state of Oklahoma along the lines similar to those that have been started in the state of Texas.

Q. Would the Bureau of Mines direct such a campaign at the expense of the Oklahoma Natural Gas Company, would you say?

A. They would not. The Bureau of Mines will not, and from the very nature, of course, cannot co-operate with a private Company. It is a Public Bureau and a part of the Federal Government, and machinery, and its co-operation consequently would be limited to other governmental agencies.

Q. If the Bureau of Mines should conduct a campaign of that sort in the State of Oklahoma, would the Federal Government pay the cost of it?

A. In order to take care of that one person's time, it would be necessary to secure a special congressional appropriation. The easiest way, if the people of Oklahoma really want to save gas is to [fol. 122] put this situation up immediately to the Congressional delegation in Congress, asking that delegation to immediately arrange that proper funds can be placed at the Bureau of Mines' disposal. If that is done, the Bureau of Mines can then, at its own governmental expense, proceed with the carrying out and direction of the campaign, using of course, state agencies to carry out the actual work.

Q. As I understand you at present there is no appropriation out of which the Bureau of Mines could pay for such an educational campaign in the state of Oklahoma?

A. That is correct.

Q. Can you tell us who is paying for the educational campaign which Miss Elfritz is carrying on at the city of Dallas, Texas?

A. The city of Dallas.

Q. Would the Bureau of Mines carry on that campaign in the State of Oklahoma and permit the Oklahoma Natural Gas Company to pay the expense of it?

A. I doubt it. I cannot express sufficiently the Bureau's policy, but I understand that is their fixed policy.

Commissioner Russell. This is election year and if our boys in Congress cannot get the necessary funds, we can elect another set this fall.

Commissioner Walker. In regard to the conservation of natural gas, I don't think there is a State in the Union that has done the work along that line that we have. Our legislature has been very liberal. We have spent over two hundred thousand dollars in this state trying to conserve gas. Our work is in the field to prevent the wasting of gas in the well, and does not extend to the question of educating the public in the use of gas equipment, excepting that in extreme cold days the Commission does cut off industrial plants [fol. 123] in the city.

The witness, Mr. Wyer: I might add, that it was my observation when with the Fuel Administration, that the State of Oklahoma had accomplished more so far as field conservation is concerned, than all the other states put together.

Mr. Richardson: Mr. Wyer, I will ask you to state why a campaign carried on by the Oklahoma Natural Gas Company and by campaign I mean a campaign for the efficient use of gas and the conservation of gas in general use, why such campaign carried on by the Oklahoma Natural Gas Company, and the Oklahoma Gas and Electric Company would not attain the same end as a campaign carried on by the State itself, through its own agencies, or by the Bureau of Mines?

A. Because the public won't believe you.

Q. And if we have been advertising such demonstrations and making such demonstrations as was made by Miss Elifritz a few minutes ago and the people would not attend them, that if the proof of that fact is it?

A. It is.

Q. Have you the pamphlet on the Use and Conservation of Natural Gas?

A. I have.

Q. May I see that a moment?

(Witness here hands counsel pamphlet.)

Q. Have you any extra copies of this pamphlet?

A. I can furnish you extra copies from my office. I do not have them with me.

Q. This pamphlet on the use and conservation of natural gas was issued by the United States Fuel Administration, bureau of oil conservation, I believe?

[fol. 124] A. That is correct.

Q. And was published in the Government printing office at Washington, in 1918?

A. Correct.

Mr. Richardson: I wish to offer in evidence that portion of page four of this pamphlet entitled Use and Conservation of Natural Gas, and this was prepared for use in Schools, was it not?

A. Correct.

Q. I mean, to be taught in schools?

A. Correct.

Mr. Richardson: I wish to offer that portion of pages 4 and 5, under the title of "Natural gas is becoming scarcer."

"The demands for natural gas are now greater than the available supply. Food and trees can be grown. Water supplies are constantly replenished by nature, but there is no regeneration in natural

gas; and when the gas is once used it is gone forever. While no one knows exactly how natural gas is formed, yet enough facts are known about it to indicate that nature's process was a very slow one. It has taken millions of years to make the present concentrated supplies, and even though gas should now be formed in some parts of of the earth's crust, the rate of formation will be so slow as to make such new gas pools of no interest or economic value for centuries. The use of natural gas is not an inalienable right, but a privilege enjoyed by about 10 per cent of our entire population in the United States, used in a most extravagant and wasteful manner, with no regard for the future and not appreciated until it is gone."

[fol. 125] Mr. Richardson: We also wish to offer that portion of page 5 from the pamphlet just identified, under the heading "Extent of waste."

"The history of the natural-gas industry is an appalling record of almost unbelievable waste. The common methods of production, transmission, and use have resulted in wasting more gas than has ever been utilized. At the present time a survey of the entire natural gas industry indicates clearly that the amount of waste even today is greater than the amount of gas actually utilized. At the present time we are wasting over 800 billion cubic feet of gas per annum. On the basis of what it would now cost to replace this ideal fuel, the money value of this waste amounts to $1,200,000,000 a year, or more than $3,000,000 per day.

There are many distributing plants that waste one-third of the gas by various forms of leakage in the town; that is, they deliver to the ultimate consumers not to exceed two-thirds of the gas received at the town limits."

Mr. Richardson: I also wish to offer in evidence that portion of this pamphlet on the use and conservation of natural gas, found on page 6 thereof, under the title "Consumer is Responsible for proper use of gas."

"The great importance of the proper position of cooking vessels is discussed elsewhere in this pamphlet. Even with high pressure and long flames, if a strong draft should deflect the flame the cooking service will be unsatisfactory. Better results can be obtained with pressures in the neighborhood of 1 ounce than at 4 ounces or higher, if the vessel is properly placed over the shorter flames resulting [fol. 126] from the lower pressure. A burner with a large number of short flames will give better results than with long flames. This is such an important feature that practically twice as much gas will be required to cook with 4 ounces of pressure as would be required for pressures of from 1 to 2 ounces."

Mr. Richardson: I wish also to offer in evidence that portion of this pamphlet entitled Use and Conservation of Natural Gas, found

on page 7 thereof, under the heading "How the Consumer can save gas," and there are some illustrations on pages 8 and 9, and the article offered ending on page 10 of the pamphlet:

Thereupon the same is read as follows:

"How the Consumer Can Save Gas

Don't burn lamps in daytime or use lamps that are improperly adjusted. Each incandescent mantle burner has an adjusting device at the base for regulating the air and gas. Both must be so adjusted as to secure the maximum illumination without any hissing or roaring sound.

Don't use more gas under hot-water tank than is necessary.

Don't burn gas without proper air mixture. If the mixture is not correct a wasteful flame will be produced. A pale blue flame will give the most efficient results.

Don't turn gas on for cooking until the vessel is ready for use. Turn it off immediately when the cooking operation is completed.

Don't use gas at high pressure with long flames. Short flames, if properly directed, consume less gas for the same cooking operation. [fol. 127] Don't turn the gas high after the cooking vessel boils. You can not make the food any hotter. It will simply boil and no more. After the contents begin to boil the same temperature can be maintained with a smaller gas consumption.

Don't keep rooms at over 68°. Don't keep windows or doors open for other than ventilating purposes; lower the temperature of the room by turning down the gas.

Don't burn gas in a furnace without automatic thermostat control. Such an automatic device is always on the job ready to prevent the overheating of rooms, and therefore waste of gas, in addition to keeping the room at a uniform temperature. The cost of such an automatic device is not large and it will soon pay for itself in the saving of gas.

Don't burn gas in an ordinary coal furnace. It is wasteful and its use requires much more gas for the same heat delivered into the room than is required with specially built natural-gas furnaces.

Don't permit gas leaks on the premises. But never hunt for a leak with a match or a light. The easiest way is to put soapsuds over the pipe or connection suspected. If gas is escaping the soapsuds will bubble. In many houses where tests have been made it has been found that about one-sixth of the total gas that passed through the meter was wasted by leaking pipe and fixtures."

Mr. Richardson. I also offer in evidence that portion of this pamphlet on the use and conservation of natural gas found on page 10, under the heading of "What is Usable Natural-gas pressure for cooking service."

(Thereupon the same is read as follows:)

"What Is Usable Natural Gas Pressure for Cooking Service?

[fol. 128] "This was determined in tests which duplicated household operations rather than fancy laboratory conditions. In these tests it was found that less gas was required at low pressures than at high pressures, and at two-tenths of an ounce pressure the natural-gas range used about 37 per cent of the heat energy of the gas, wasting about 63 per cent; and that at 4 ounces pressure the natural-gas range utilized only 13 per cent of the heating energy of the gas, wasting 87 per cent."

Mr. Richardson: I also offer that portion of this pamphlet on Use and Conservation of Natural Gas, found on page 12 thereof, under the heading Accuracy of Meter registration at low and various gas pressured.

(Thereupon the same was read as follows:)

"Accuracy of Meter Registration at Low and Various Gas Pressures

The popular belief is that meters run faster when the pressure is low than when the pressure is high. This is contrary to the facts. Variation in pressure makes no appreciable difference in the registration of the meter, the meter merely registering, within a reasonable limit of tolerance, the amount of gas that passes, and this is neither increased, nor decreased by changes in pressure."

Mr. Richardson: Also I offer in evidence that portion of this pamphlet entitled Use and Conservation of Natural Gas, under the heading Conclusions, found on page 14 of said pamphlet.

(Thereupon the same was read in evidence as follows:)

[fol. 129] "Conclusions

1. Satisfactory cooking operations in frying potatoes, boiling potatoes, frying beefsteak, and pan-broiling beefsteak can be carried on with 0.2 ounce natural gas pressure.

2. The changes in vessel position necessary to permit satisfactory operation at pressures as low as 0.2 ounce are easy to make and require no special changes in existing stoves.

3. Bread can be satisfactorily baked with 0.5 ounce natural gas pressure.

4. Natural gas stoves are not properly constructed to use natural gas efficiently at high pressures nor satisfactorily at low pressure.

5. At high pressure natural gas stoves are inefficient and therefore wasteful in their use of gas.

6. The burners on natural gas stoves are too low.

7. The holes in the spuds of natural gas stoves are too small.

8. Long flames for cooking operations are wasteful.

9. The maximum results are obtained with many short flames, rather than a few long flames.

10. A strong draft of air may deflect the flame away from cooking vessel so as to seriously interfere with and in many cases stop cooking.

11. Where two flames strike each other, due to the fact that openings are too close in burner, poor combustion will result. This will produce a luminous flame, which will in turn result in a smoking burner. Neither air nor gas adjustment can overcome this.

12. Drilled burners are better than slotted burners, because there is less likelihood of two adjacent flames striking against each other, therefore producing imperfect combustion conditions.

[fol. 130] 13. Natural gas cook stoves should not be furnished with solid stove tops, since this suggests the carrying on of cooking operations on top of the stove rather than with the vessel in the proper position.

14. At low pressures no perceptible change can be made in the combustion conditions by adjusting the air shutter. The best conditions obtained were with the shutter wide open.

15. Too much heat is used in most cooking operations. Correct application is more important than mere intensity.

16. The natural-gas pressures carried in most natural-gas distributing plants are too high for efficient operation.

17. Meter registration is approximately correct regardless as to variation in pressure. That is, meters do not run faster when the pressure is low.

18. Lowering the temperature of natural gas increases its heating value per cubic foot. Natural gas has a temperature about 25° lower in the coldest month in winter than in the hottest month in summer, and the heating value per cubic foot due to change in temperature is therefore about 5 per cent higher in the coldest month in winter than in the warmest month in summer.

19. The maximum possible variation of heating value due to variation in gauge pressure would make the heating value during the low-pressure periods in winter less than 3 per cent lower than during the high-pressure period in summer.

20. Since the heating value increase due to low temperature of gas in winter more than off-sets the possible decrease in heating value due to low pressure the practical effect of the two is that the heating value per cubic foot of natural gas as served in the winter under low pressure and low temperature is higher than that served [fol. 131] in the summer under higher pressures and higher temperature.

21. Variation in barometer from day to day may make more of a change in the heating value of gas than any possible variation in guage pressure.

22. Better and more efficient service could be rendered if natural gas were generally lowered to probably 2 ounces, rather than increased to 4 ounces or above.

23. The lowering of natural gas distributing pressure to approximately 2 ounces would produce more efficient and satisfactory operating conditions for the consumer, would greatly curtail the leakage on the consumer's premises, which is paid for by the consumer, and would also substantially lower the leakage in the gas company's distributing plant."

Q. Have you Walker's Kansas Gas Report?

A. I have.

Q. This report was prepared by Mr. P. F. Walker, Professor of mechanical engineering in the University of Kansas, was it not?

A. It was.

Q. That is a bulletin of the University of Kansas?

A. It is.

Q. Are there any additional copies of this bulletin?

A. I understand not. I understand it is out of print. We could very easily make some photostatic copies.

Mr. Richardson: We offer in evidence page 34, of Walker's Kansas Gas report, the same being a bulletin issued by the University of Kansas, dated July 1, 1912, Engineering Bulletin No. 2, entitled "Natural gas, its properties, its domestic use, and its measurement by meters, "prepared by P. F. Walker, Professor of Mechanical [fol. 132] Engineering of the University of Kansas, the portion of which we offer in evidence is that found on page 34, under the title "Conclusions," and as there is only a page of it I shall read it into the record.

"Changes in pressure produces no appreciable effect in meter accuracy. Each cubic foot passing registers itself within a limit of error, which, by proper adjustment, may be kept within 3 per cent with all common forms of meters. The ideal value of a cubic foot of gas as fuel varies with absolute pressure in the pipe line and inversely as the absolute pressure. Changes in absolute pressure

may be due either to fluctuations in the pressure above atmosphere maintained by the supplying gas company, usually within limits of eight inches of water maximum, and two inches of water minimum, in the distributing line in cold weather, or, to fluctuations in barometric pressure due to natural causes. The latter will amount to considerably more than the former. The maximum variation all told from any one of these causes is not likely to amount to more than 3 per cent and is surely a negligible quantity. Low pressure exists for so few hours in the year that the trouble involved in determining the changed value would be more than the gain to be expected therefrom. The real invariable loss in the value of the gas at low pressure arises from the fact that the highest value cannot be utilized with the same efficiency as at the higher pressure. This loss will amount to 5 per cent in ordinary furnaces. The most serious result of the Company's inability to maintain a pressure of 4 inches of water or more is that a sufficient amount of gas cannot be drawn from the line through the standard mixer and burner. The consumer gets practically all they pay for and are able to utilize it 95% as effectively as when the pressure was high, but they cannot [fol. 133] *cannot* get all that they need. If high pressure was maintained, more gas would be used and the bills would be higher than they will with low gas under present conditions, but if the consumer got all he needed for comfort he would be more content to pay the larger bills."

Q. Now when he speaks of pressure ranging within the limits of eight inches water maximum, and two inches of water minimum, and when he speaks of the Company's inability to maintain a pressure of four inches of water, will you state what relation pressure registered by inches of water bears to pressure registered by ounces?

A. One ounce per square inch is equivalent to 1.73 inches of water pressure.

Q. Then four inches of water would be about two and a quarter ounces of pressure?

A. Correct.

Commissioner Walker. What was that report that you have read, Judge. That is just what we are up against on this Commission all the time. People had rather pay more for gas if they could get what they want.

Mr. Richardson. We will take up the question of supply after we have finished with this gentleman.

Mr. Wyer. If you will educate that man up to using it conservatively, you will treble the available supply.

Commissioner Walker. Suppose we issued an order prohibiting the use of natural gas in furnaces that would cut the revenues of the company down so low as to make it impossible to operate.

Mr. Wyer. Make an order requiring the gas company to make an inspection of all consumers' appliances and make a classification of those that are efficient, and those that are not efficient.

[fol. 134] Commissioner Walker: This Commission is in a peculiar position. We pass on the rate to charge for gas in this state, and at the same time we pass on the question of the service to the people. It has never been the disposition of the Commission to make those rates so low but what the boys could get a fair return on the investment, *but along with the* rates we have got a demand for service.

Mr. Wyer. The only way that you will ever get adequate service is to make the gas worth conserving, and the only way you can get the consumers to pay increased prices without vigorous protest is to show him how he can pay a much larger price per thousand without any increased annual cost.

Commissioner Walker. Take this town for illustration. Suppose we would say the price of natural gas is $1.00 per thousand in Oklahoma City. How is that going to do any good when in the southeast part of town the gas goes out entirely?

Mr. Wyer. For the simple reason when you make gas $1.00 per thousand in Oklahoma City, every consumer will have some real incentive to raise the burners on his stove and to put in efficient appliances, and when he does that you can get one foot of gas to do the work of three. Therefore, raising the price would have the practical effect of making three times more gas available because we could get the same cooking, lighting, and heating service if efficiency used with one-third the amount of gas, and yet at the higher price per thousand feet their annual cost would be substantially no more. I agree with you absolutely, you can not separate the matter of service and rates. The two must go hand in hand.

Mr. Richardson. I want to ask you if a natural gas company which deals in a commodity that has natural limitations, is not [fol. 135] negligent or indifferent with respect to its obligation to the public and exercises all reasonable care to procure and furnish an adequate supply of gas that any reasonable person engaged in the same business would do, and its failure to furnish all the people need or want is due solely to the fact that such a supply is not available to it within reasonable limits of expenditure, or in reasonable amounts, then would the fact that the supply of gas is not adequate to meet the needs or wants of the people, justify requiring the gas company to discount its bills?

A. It would not, and any such arrangement——

Q. I am asking you that because you said that service and size of bills went hand in hand.

A. It would not, and any such arrangement would violate every fundamental principle of natural gas conservation because you merely put a premium on waste and if the consumers in Oklahoma City, for instance, knew today that because of low pressure of gas the gas would not cost them anything, it is only the typical American habit to use just that much more which has the im-

mediate practical effect of making a bad situation just that much worse.

Q. Ask you if this is not also true. That the distinguishing feature existing between the natural gas service and other services, other public services, which feature is due to the fact that persons engaged in the business of furnishing natural gas, are furnishing a commodity which has a natural limitation?

A. That is correct.

Q. If there could be said to be an absolute duty to furnish adequate service with respect to any public utility, could such a duty be absolute with respect to gas companies where the supply [fol. 136] was such that it could not be performed?

A. It would be physically impossible to comply with it.

Q. Have you the pamphlet on the value of gas delivered at varying pressures, by Mr. Critchfield? A bulletin?

A. I have.

Q. Have you more than one copy of that?

A. I can get additional copies.

Q. Can you get us as many as ten copies of this?

A. I can.

Q. Now this bulletin was prepared by Mr. Charles V. Critchfield, and is entitled, "The value of gas delivered at varying pressures." Who is Mr. Critchfield?

A. At the time of the preparation of that bulletin, Mr. Critchfield was the natural gas expert of the Public Utilities Commission of the State of Ohio, and that was prepared for and on behalf of that Commission.

Q. And this seems to have been presented at the annual meeting of The Natural Gas Association of America, at Pittsburgh, Pennsylvania, on May 22nd and 23rd, 1918?

A. That is correct.

Q. Do you know what Mr. Critchfield's reputation is with respect to competency in the natural gas business?

A. He would be competent. He was the Gas Expert for the State Commission.

Mr. Richardson: We offer in evidence, pages 9, 10, 11, 12, and 13 of this bulletin, omitting the illustrations; offering only the text, as follows:

"To return to the subject of the value of gas at varying pressures, I call attention to the following cut illustrating a simple and I believe a reliable method of ascertaining by actual measurement [fol. 137] the amount of expansion due to the reduction of pressure.

This view shows two 10 ft. meters provers rigidly connected by a short length of ¾ in. pipe. Prover No. 1, has its bell weighted to a pressure of 4 oz. per square inch. Prover No. 2 has its bell weighted to a pressure of 1 ounce. After thoroughly purging both the provers, No. 1, was filled with gas and then allowed to force

its contents into Prover No. 2. As the scale of Prover No. 1, indicated a transfer of 8 cubic feet of gas, the scale of Prover No. 2, indicated 8.125 cubic feet or an expansion of 1.56%. To check this test the provers were reversed, i. e., the pressure on Prover No. 2 was increased to 4 ounces and that of No. 1 reduced to 1 ounce, with the same results. It will be noted that the percentage of expansion runs very close to the theoretical value and I believe with refined instruments, the results would coincide.

To make a similar demonstration, using domestic meters in place of provers, three meters were connected in series with some house regulators between. One was introduced into the first meter at 4 ounces, reduced and passed into the second meter at 2 ounces, and further reduced and passed through the third, or last, meter at 1 ounce. The amount of gas registered in the third meter was 1½% more than by the first, while the difference between the first and second, and the second and third, was too slight to detect. The following view shows the arrangement of meters and regulators except that, in assembling them for the photographer, the regulators were inadvertently connected onto the outlet instead of the inlet side of the meters. A further demonstration of the degree of expansion as expressed in heat units was secured in [fol. 138] repeated tests by the calorimeter with natural gas under 4 ounces and 1 ounce pressure. The loss in heat units when the pressure was reduced from 4 ounces to 1 ounce, was so slight that it was covered up by the ordinary trivial errors made in the observations.

These three demonstrations prove conclusively that the amount of expansion following a lowering of pressures from 4 ounces to 1 ounce, is very slight, and, since domestic meters measure volumes irrespective of pressure, the increased amount of gas passing through and registered by meters at times when pressures are extremely low, is shown in the following table.

Based upon 1,000 feet of gas delivered to the consumer under a pressure of 4 ounces meter would register an additional amount over 1,000 feet as follows

Pressure	Cubic feet
4 oz.	1,000
3½ oz.	1,002.1
3 oz.	1,004.3
2½ oz.	1,006.4
2 oz.	1,008.6
1½ oz.	1,010.7
1 oz.	1,012.9
½ oz.	1,015.1

Our experiments so far relate to the second item in which the consumer is interested, viz. the amount, or cost, of gas used. Passing to the first item, i. e., the results obtained in the appliances, our

experiments relating to gas values at varying pressures would indicate, that the unsatisfactory results of sub-normal pressures are due, in the main to appliances so inflexible that they operate efficiently, as well as economically, only at some predetermined pressure."

Then he goes into a discussion of heat. Now there is a part of this, Mr. Wyer, that says, based upon 1000 feet of gas delivered to the [fol. 139] consumer under a pressure of four ounces pressure, would register an additional amount over 1,000 feet, when delivered at a lesser pressure, and then says that 1000 feet of gas delivered at four ounce pressure would register on the meter 1000 feet, and then if the pressure is reduced to 2½ ounces, the same quantity of gas would register 1,008.6, and at 1 ounce would register 1,012.9, what does he mean by that.—I know, it has just percolated through. If you take 1000 cubic feet of gas and put it through at 4 ounces it will register 1000 feet, but if you put the same quantity through at a less pressure, say at three ounces, it will register more than 1000, is that it?

A. Yes sir.

Q. Because I thought it was the reverse of what we had had. Now have you technical paper 257. What he means in that table was that 1000 cubic feet of gas at four ounces, if put through at a two ounce pressure it would be more than 1000 feet, and that table shows how much more?

A. Let me suggest that you lawyers don't try to improve on the phraseology of our scientific men. You are getting that in such shape that the court will have difficulty in determining that. There is the danger. You have two comparisons, one made in one direction, and the other, going in the other direction, and to the lay-mind it will be misleading.

Q. I understand this now, but I want to ask you about it so we will not misunderstand it.

A. Let me make this general statement. The whole text of the relationship of pressure and volume that have been introduced, all refer to exactly the same natural laws as applied to the effect of pres- [fol. 140] sure on gas volume, although stated differently at different times. That all means exactly the same thing.

Commissioner Russell. I think the Commission understands it, except that in one illustration it was 12.9 and another it was 13, that is getting pretty close.

Q. I have here Technical paper 257. Department of the Interior, Franklin K. Lane, Secretary, Bureau of Mines, Van. H. Manning, Director, entitled "Waste and correct use of natural gas in the home," by Samuel S. Wyer, and printed in the Washington Government Printing office under date 1920. Are you the author of that paper?

A. I am.

Mr. Richardson: Now I have been promised by the Interior Department, a large number of copies of this paper, and for that reason

I am not going to read it into the record. I offer the entire pamphlet in evidence. There will be enough copies to supply each record with one, and it will not be necessary to copy it into the record. It can be inserted when they are received.

(There being no objection, the same was received in evidence and is as follows, to-wit:)

[fol. 141] EXHIBIT TO TESTIMONY OF SAMUEL S. WYER

(Here follows pamphlet, "Waste and correct use of natural gas in the home.")

Technical Paper 257

DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary
BUREAU OF MINES
VAN. H. MANNING, Director

WASTE AND CORRECT USE OF NATURAL GAS IN THE HOME

BY

SAMUEL S. WYER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1920

ILLUSTRATIONS.

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FOREWORD.

Much has been said by the Bureau of Mines and by others about the criminal waste of natural gas that is taking place in our gas fields. Natural gas, one of the most valuable mineral assets of the country, has been permitted to dissipate in such a manner that the public has derived relatively small value from it. In recent years the public has demanded that efforts be made to minimize this waste.

But, although possibly the most flagrant and the largest wastes have been in the fields and along the transmission lines of the gas companies, there have been great wastes in the household of every consumer, and the public, therefore, has been a party to this crime. Investigations as to the efficiency with which the domestic consumer uses the gas supplied to him have disclosed that perhaps two-thirds of the gas that has been metered into his house has been wasted and only one-third of the gas has been consumed usefully. The following figures contributed by Mr. Wyer show how such wastes occur:

"Domestic consumers waste more than 80 per cent of the gas received. The efficiency of most cooking and heating appliances could be trebled. By making natural gas worth saving the 2,400,000 domestic consumers in the United States could get the same cooking and heating service with one-third of the gas—that is, make 1 foot of gas do the work of 3—and greatly delay the day when the present supplies will be exhausted and consumers must go back to more expensive manufactured gas."

It is time for the public to take a new viewpoint on the waste of natural gas. It is time for the domestic consumer to realize that his duty is not done when he cries out against the flagrant wastes occurring in the gas fields, and demands of his Government that such wastes be abated; he must realize that he himself is likewise at fault and that it is time for him to set his own house in order. Furthermore, the domestic consumer must realize that these wastes do not concern him alone, and consequently he has not the right, merely because he pays for the gas, to employ it in any manner that pleases him, no matter how wasteful. Natural gas is a natural resource in which every inhabitant of this country has an equity. Those who waste the gas do so at the expense of others who would use it efficiently. Natural gas is not replaced by nature, and in comparison with the life of the nation the duration of the supply will be brief.

The public has a right, therefore, to demand that this natural asset be used to the greatest advantage of all and that no one be allowed to waste it. Natural gas in each city is a community asset and every consumer has a right to demand that wasteful use shall be prohibited in the interest of the public service. This is particularly important during cold spells in the winter when the supply is insufficient and actual suffering may occur. Clearly, it is not right that any consumer suffer at such times because of the extravagance and waste of other consumers, even though they are willing to pay for the gas wasted. Nor can the citizens justify demands for better service from the public utility companies without making provision to correct abuses in their own homes. It must be recognized that the public has been and is to-day, just as much a party to the crime of wasting this natural resource as are the companies that produce and market it.

VAN. H. MANNING,
Director.

WASTE AND CORRECT USE OF NATURAL GAS IN THE HOME.

By SAMUEL S. WYER.

PART I.—CORRECT USE OF NATURAL GAS IN THE HOME.*

SECTION 1.—CONSUMERS' METHODS OF GAS UTILIZATION DETERMINE QUALITY OF SERVICE PRODUCED.

Gas service is radically different from every other kind of public utility service in that the gas can not be used by the consumer as received, but—

First, must be mixed in proper proportion with another substance (atmospheric air);

Second, this mixture must then be completely burned;

Third, the flame must be so directed that the heat generated will effectively get into the food, air, water, or mantle that is being heated, with a minimum loss.

The results obtained will depend primarily on the gas utilization appliance and the consumers' skill and care in operating. All these operating features are beyond the gas company's control, but are vital in determining the quality of the service produced by one consumer and the effect on the service of other consumers.

SEC. 2.—COMBUSTION OF NATURAL GAS.

The combustion—that is, the burning of natural gas—can take place only by first mixing the gas with the proper proportion of atmospheric air. About 9½ cubic feet of air must be mixed, by the gas consumer at his burning appliances, with each cubic foot of natural gas in order to insure perfect combustion. If not enough air is mixed with the gas, the combustion will be imperfect and wasteful.

SEC. 3.—WHAT MUST HAPPEN WHEN NATURAL GAS IS BURNED.

When natural gas is burned by complete combustion, each cubic foot of the gas will form 1 cubic foot of carbon dioxide and 2 cubic

*For further discussions of gas use, see Bulletins of the Department of Home Economics, Ohio State University, Columbus, Ohio, as follows: Bulletin 28, "Effect of gas pressure on natural gas cooking operations in the home," May, 1918; Bulletin —, "Kitchen tests of relative costs of five fuels for cooking." Reprinted October, 1918.

feet of steam. This carbon dioxide is the same substance that is exhaled from the lungs.

The combustion of 1,000 cubic feet of natural gas will form 2,000 cubic feet of water vapor or steam, which, when condensed, will make approximately 10½ gallons of water. This production of vapor is not peculiar to natural gas, as ordinarily manufactured gas of the same heating value will form about the same quantity of water vapor. It is this water vapor that causes the bakers and broilers of stoves to rust, and, when gas is used in open fires without flues, may make the walls and windows "sweat."

SEC. 4.—WHAT MAY HAPPEN WHEN NATURAL GAS IS BURNED.

If the combustion of natural gas is not complete, carbon monoxide will be formed instead of carbon dioxide. This carbon monoxide is a deadly poison and, therefore, dangerous, and for this reason a room in which gas is burned must be ventilated. The poisonous action of carbon monoxide gas is so marked that one-tenth of 1 per cent is enough to in time produce fatal results. This gas is especially likely to be formed when a flame suddenly strikes a cold surface, as, for instance, during the first few minutes' operation of a hot-water heater.

SEC. 5. COMBUSTION PRODUCTS OF NATURAL GAS CAN NOT BE ABSORBED OR DESTROYED.

The inevitable products, carbon dioxide and water vapor, can not be destroyed, although the water vapor when it is cooled will condense to a liquid. There have been many claims made by manufacturers of heating devices that their devices absorb the combustion products, but all such claims are untruthful.

SEC. 6.—BLUE AND YELLOW FLAME BURNERS.

If natural gas is forced out through a small hole, about the diameter of a pin, enough air can be mixed with the issuing gas to insure perfect combustion. This is the principle of the yellow or luminous flame burner. The flames must not be suddenly permitted to come in contact with any solid body, because if they do they will deposit carbon and probably produce carbon monoxide. Only very small quantities of natural gas can be burned in such burners. In this yellow or luminous type of flame the production of the light is due to the incandescence of momentarily existing carbon particles furnished by the decomposition—by heat—of the gas itself, before coming in contact with the air.

Natural gas, to be burned in large volume, must have some of the air mixed with the gas before the gas reaches the flame. This is

the fundamental principle of the Bunsen or blue-flame type of burner. The air taken in to form the mixture is called the primary air, and will usually be only a small part of the total air required. The rest of the air necessary for complete combustion, called the secondary air, will be taken from the atmosphere surrounding the burning flame. Such a blue flame does not smoke or deposit free carbon on a cool surface, although if the flame is sufficiently chilled some of the gas will escape unburned.

SEC. 7.—ACTION OF GAS MIXER.

The action of the mixer is shown in figure 1. The gas, at a pressure above atmospheric air, is forced through a small hole or orifice by the gage pressure in the gas pipe, and thus acquires a

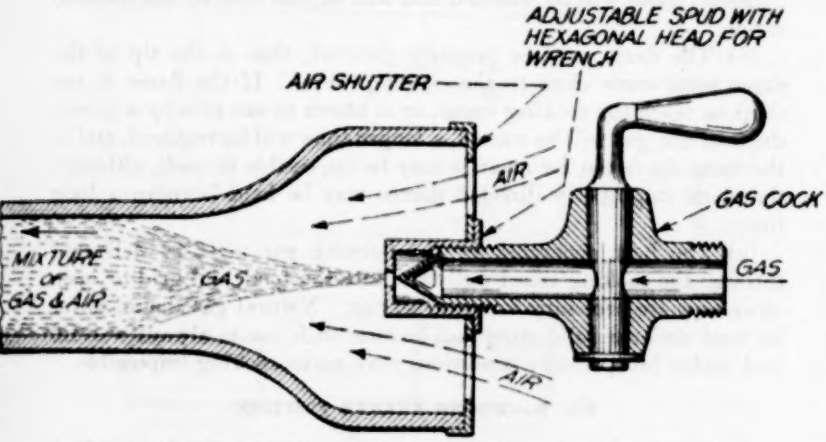

FIGURE 1.—Diagram showing construction of gas mixer, with adjustable spud.

relatively high velocity in passing through the small opening, as shown in the figure. In this way an asperating or sucking action is produced around the orifice, and this draws in atmospheric air from the room so that it will mingle with the gas. A gas mixer is, therefore, in effect merely a small air injector. The mixer shown in figure 1 has a stationary cone, and by turning the adjustable spud with a wrench placed on the hexagonal head of the spud, the effective area of the orifice may be made larger or smaller, thus changing the velocity of the gas, and, therefore, its asperating action. This is known as the adjustable type of spud.

By opening up this adjustable spud when the gas pressure is low, more gas can be gotten to the burner, and, therefore, more satisfactory operating conditions can be secured during the inevitable low pressure period in extreme cold weather.

There are many mixers in use that have merely a stationary spud opening, which can not be adjusted.

The amount of air going in may be varied by adjusting the air shutter.

The mixer shown is of the type generally used on cooking stoves, but the same principle is employed in heating stoves and incandescent mantle lamps. In many burners a needle valve is used instead of the gas cock shown for controlling the gas going to the orifice.

SEC. 8.—IN BURNING GAS FOR COOKING THREE DISTINCT STEPS ARE NECESSARY.

(*a*) The gas must be properly burned; that is, it must be properly mixed with air so as to burn with a pale blue nonluminous flame. A luminous flame will be wasteful and will deposit soot on the cooking vessel.

(*b*) The flame must be properly directed; that is, the tip of the flame must come close to the cooking vessel. If the flame is too short to reach the cooking vessel, or is blown to one side by a strong draft of air, gas will be wasted, a longer time will be required, and if the flame tip is too far away it may be impossible to cook, although the short improperly directed flames may be kept burning a long time.

(*c*) The heat generated by the burning gas must be delivered through the cooking vessel walls and into the food, and grid or open stove tops are necessary for good service. Natural gas should never be used under a solid stove top because such use is always wastful and under low-pressure conditions may make cooking impossible.

SEC. 9.—WRONG BURNER POSITION.

Wrong positions are shown in A and B of figure 2. At A, which represents a typical natural gas stove condition, high pressures are necessary, and although the flame with such high pressures will be effective, it will always be wasteful of gas. When the pressure is low so as to produce the short flame shown at B, the cooking vessel is so far away that the short flame can not reach it. This results in waste of gas, longer time being required for cooking, and often inability to cook at all, even though the gas may be burned for a long time.

SEC. 10.—CORRECT BURNER POSITION.

Merely lowering the cooking vessel or raising the burner, as shown at C in figure 2, will result in satisfactory cooking in the usual length of time, with low-pressure gas in the same stove and with the same burner. In fact, with a properly directed short flame at low pressures, as shown at C, the amount of gas used will be less than one-half

of the amount needed with the usual high pressure and shown at A.

SEC. 11.—HOW TO GET COOKING BURNERS IN CORRECT POSITION.

When purchasing a new stove, get either a manufactured or a natural gas stove with burners properly raised for service. The burner should be about 1¼ inches below the cooking vessel.

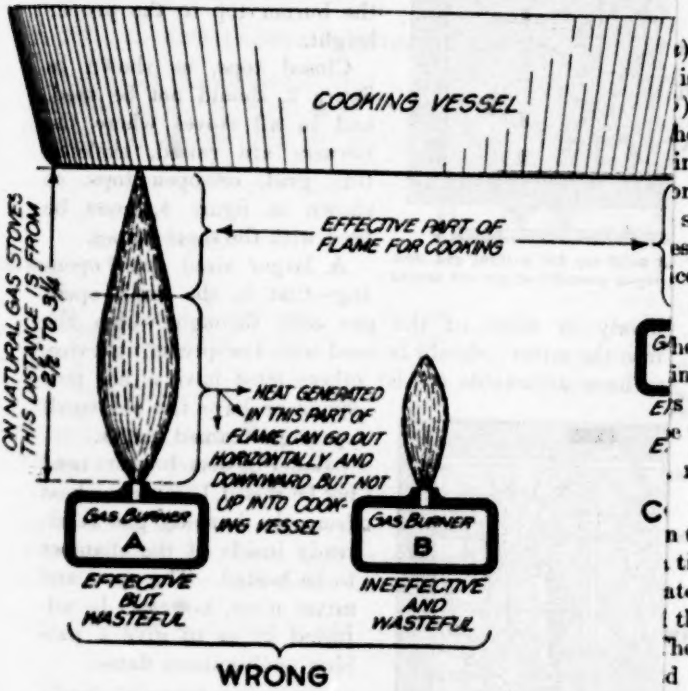
COOKING VESSEL
EFFECTIVE PART OF FLAME FOR COOKING
ON NATURAL GAS STOVES THIS DISTANCE IS FROM 2½ TO 3½
HEAT GENERATED IN THIS PART OF FLAME CAN GO OUT HORIZONTALLY AND DOWNWARD BUT NOT UP INTO COOKING VESSEL
GAS BURNER A
GAS BURNER B
EFFECTIVE BUT WASTEFUL
INEFFECTIVE AND WASTEFUL
WRONG

FIGURE 2.—Diagram showing wrong and correct position of gas flame under vessel.

Old stoves worth remodeling may be changed by:

(*a*) Raising the manifold and burner supports so as to bring burners to the proper height below the cooking vessel.

(*b*) In some stoves the manifold may be turned on end or around so that valves that are at the bottom will then come at the top. By altering the burner supports, the burners can then also be brought to the proper height. In some stoves where connections to the one shown in figure 1 are screwed into the manifold

the manifold one-quarter way around, removing the cocks, screwing a nipple and elbow into the upturned opening, placing the cock in the elbow and raising the burner supports, will usually bring the burners to the proper position.

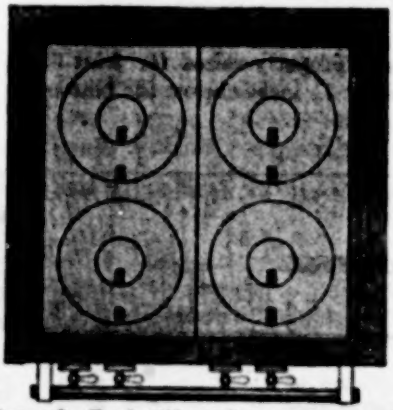

FIGURE 3.—Usual solid top for natural gas cook stove. Such a top is wasteful of gas and should not be used.

(c) In some stoves it will be preferable to cement a new burner casting on top of existing low burners, so as to bring the burner top to the proper height.

Closed tops, as shown in figure 3, should not be used, and in all stoves where the burners are raised, skeleton lids, grid, or open tops, as shown in figure 4, must be used with the short flames.

A larger sized spud opening—that is, the small opening immediately in front of the gas cock through which the gas passes into the mixer—should be used with low-pressure service. Some stoves have adjustable spuds; others must have either new spuds or have the old small openings reamed larger.

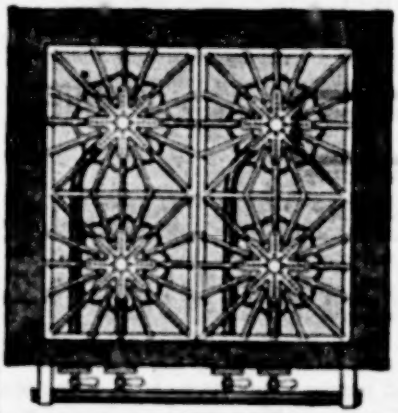

FIGURE 4.—Grate or grid top for gas cook stove. This top is official and should be used with natural gas.

Baker or oven burners need not be raised, because the heat from the burning gas is already inside of the chamber to be heated. The spud and mixer must, however, be adjusted so as to give a pale blue nonluminous flame.

SEC. 12.—HOW TO COOK WITH VERY LOW GAS PRESSURE.

In cold weather, when the demand for natural gas is greater than the supply and the pressure is therefore low, lowering the cooking vessel down to within one-half inch of the burner top may be desirable. This may be done by placing three or four nails in drilled burners, or three or four pieces of thin sheet iron in slotted burners, as shown

in figure 5, and then placing the vessel on these nails or sheet-iron supports so that the very short flames from the low-pressure gas will reach the bottom of the cooking vessel. If this is done, satisfactory cooking results can be obtained with pressures as low as three-tenths of an inch of water pressure, which produces a flame about three-eighths of an inch long. That is, with this close position of the vessel the cooking can be accomplished in about the normal time and with less gas than would be used with the long flame and high pressure necessary to produce the condition shown in A of figure 2.

SEC. 13.—HOW TO COOK EFFICIENTLY WITH HIGH PRESSURES.

First raise the burners so that the vessel will be about 1¼ inches above the burner openings, then efficient short-flame combustion conditions may be obtained by partly opening the gas cock. Never

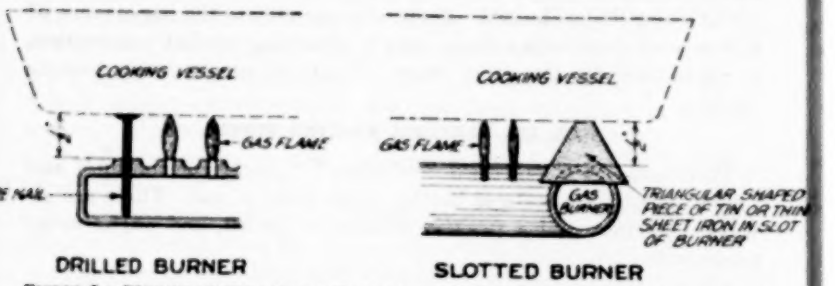

FIGURE 5.—Diagram showing how nails or pieces of sheet iron may be used to support cooking vessels close to gas burner for effective service at low pressure.

let the flame lick up along the side of the vessel. If the full pressure is turned on, it may be so high as to actually blow out the flame and give the erroneous impression that the gas will not burn.

SEC. 14.—WHY MORE GAS IS USED FOR COOKING IN WINTER THAN IN SUMMER.

The heating value of the gas in winter will not be any lower than in summer, because the heating value is increased 1 per cent for each 5 degrees of decrease in temperature of the gas, and will actually be higher during the low-pressure period in winter than it is in summer. However, the starting temperature of the food and water that must be heated in cooking will be much lower in winter than in summer, therefore a larger quantity of heat will be needed to bring the food or water to the boiling point. The radiating loss from the cooking vessel and burner, because of the low temperature of the surrounding air, will also be much higher in winter than in summer, and thus will increase the gas consumption.

SEC. 15.—RUSTING OF OVENS AND BURNERS.

Rusting of ovens can almost be eliminated by opening the oven door slightly for a few minutes after the burners are lighted. This permits escape of the greater part of the moisture, which is produced by combustion, and prevents too rapid condensation.

Oven linings and burners are best protected from rust by the application of oil or grease, free from salt. This should be done while the oven is warm, as often as may be necessary.

SEC 16.—STEPS NECESSARY IN CORRECT HOUSE HEATING.

(*a*) The gas must be burned with perfect combustion. However, this is merely the first step.

(*b*) The combustion products must be made to deliver the most of their heat into the air or water that is to be heated, and before leaving the heating device should be cooled to within 100 degrees of the air or water that is heated. Failure to appreciate the importance of this second step, rather than merely obtaining perfect combustion, is responsible for the gross waste of natural gas in many heating devices.

SEC. 17.—FLUELESS HEATING STOVES.

There are many so-called "odorless," "smoke-consuming," and "chimneyless" natural-gas heating appliances in use. These are always dangerous and a positive menace to health, and ought never to be used.

SEC. 18.—WHY FLUELESS HEATING STOVES ARE MUCH MORE DANGEROUS THAN A FLUELESS COOK STOVE.

In the kitchen the cook stove is seldom used for more than one hour at a time. The volume of steam from the cooking food will be much greater than the volume of the combustion products from the gas, and the steam alone will make ventilation necessary.

The person in the room will be constantly moving about, with head 4 or 5 feet above the floor level, and in all probability the kitchen door will be opened several times during the cooking, thus increasing the ventilation.

In contrast with this condition, when a heating stove is used in a bedroom or bathroom, the period of use is much longer, the ventilation is less, the person in the room will be quiet with head closer to the floor, and the doors will probably, at least in the bedroom, not be opened or closed. Furthermore, a flueless stove properly adjusted at 9 o'clock in the evening, when the pressure is low and when the person goes to bed may become a carbon monoxide generator at 3 o'clock in the morning, when the person is asleep and the gas pressure has greatly increased.

Hoods over open-top kitchen stoves, of course, are always desirable.

SEC. 19.—NATURAL GAS CHIMNEY TROUBLES.

The water vapor in the combustion products of natural gas, when turned into the ordinary brick, mortar-lined, or fire-clay-lined chimney, will in time cause the mortar to disintegrate; also the condensed water will work through the porous brick and frequently discolor the walls on the inside of the room, as well as disfigure the exterior of the chimney. The best way to handle the combustion products of natural gas is to have a metal or vitrified pipe in the chimney.

SEC. 20.—WHY THE HEATING VALUE OF NATURAL GAS MAY SEEM LOWER ON WINDY DAYS THAN ON EQUALLY COLD STILL DAYS.

The wind has no effect on the heating value of the gas, but may affect the consumer's use as follows:

(*a*) A strong wind may deflect the flame from under the cooking vessel and thus lower the efficiency of the gas for cooking. Protection of the flame from a strong draft will correct this difficulty.

(*b*) For heating stoves an excessive draft caused by a high wind may take a larger amount of the heat produced up the chimney, thereby greatly increasing the chimney loss, and of course, depriving the room of that much heat. Cutting down the draft with a damper will correct this.

(*c*) Most houses are rather loosely constructed and are more susceptible to a high, cold wind than to merely a cold, quiet atmosphere, even though the quiet atmosphere may be much colder than the rapidly moving wind. The practical effect of this is that a high wind will bring an excessive proportion of cold air into the house and thereby increase the heating demands on extremely windy days.

SEC. 21.—INCANDESCENT MANTLE LAMPS.

The incandescent gas mantle lamp is simply a Bunsen burner where the burning gas heats the material in the mantle to incandescence, thereby producing light. The lamp must be closely adjusted if efficient and satisfactory results are to be obtained. Hissing or roaring sounds are indicative of excessive gas consumption. Adjust the lamp by adjusting the air shutter and gas needle valve of the burner—if the burner has one—so as to obtain a maximum illumination and a quietly burning lamp.

PART II.—FORMS OF NATURAL GAS WASTE IN THE HOME.

SEC. 22.—WASTE FROM GAS LEAKAGE.

The various gas cocks, fittings, and piping on the consumers' premises are seldom tight, and will frequently waste a large amount of gas in a year through leakage. Even a leakage of only 1 cubic foot per hour will mean 8,760 cubic feet of gas per year, or about one-twelfth of the average consumer's annual domestic consumption. The

average leakage will be more nearly 15 per cent of the gas passing through the consumer's meter. Most gas meters have a small dial indicating either 1 or 2 cubic feet of gas per revolution. Shutting off all the burning gas in the house and noting the movement on this small dial for a period of two or three hours will give a good indication as to leakage.

SEC. 33.—WASTE FROM HIGH PRESSURE.

High pressure gas; that is, gas under a pressure of 4 ounces per square inch, will frequently cause the blowing of the burners, usually indicated by a hissing sound. Partly opening the gas cock will remedy this.

SEC. 34.—WASTE FROM IMPERFECT COMBUSTION.

With the Bunsen type of blue flame burner, a showing of red or yellow in the flame is an indication of imperfect combustion and, therefore, waste. Unburned gas will cause smoke and the depositing of soot on the cooking vessel. Adjusting the air shutter and gas supply is the remedy.

SEC. 35.—WASTE FROM LOW BURNERS IN COOK STOVES.

The long flames necessary for low burners always require more gas than those from the burners in proper position about 1¼ inches below the vessel bottom. Raising the burners to the proper height will correct this.

SEC. 36.—WASTE FROM IMPROPERLY DIRECTED FLAMES.

A strong draft or the opening of doors may frequently deflect the flame under cooking vessels so that the heat will not get into a vessel. Cutting down the chimney draft or protecting the flame from side drafts will correct this.

SEC. 37.—WASTE FROM SOLID TOPS ON COOK STOVES.

If cooking operations are on top of the stove, more gas and a longer time are required. The use of skeleton lids or grid tops will eliminate this waste.

SEC. 38.—WASTE FROM USING GAS BEFORE AND AFTER COOKING.

Most persons do not appreciate that the burning gas can do no good before the vessel is over the fire or after the vessel is taken away. Therefore, the gas should not be turned on until after the vessel is ready to place over the fire, and should be turned off as soon as the vessel is removed.

The gas can be turned down after boiling begins, and the vessel can be kept boiling with a smaller quantity of gas. It is important to bear in mind that when a cooking vessel boils it can not be made any hotter and any use of gas other that merely to keep it boiling is a waste.

SEC. 29.—WASTE FROM USING GAS IN COAL STOVES OR COAL FURNACES.

In coal stoves or coal furnaces the path traveled by the flame is short and the radiating surface is relatively small. For this reason, the use of gas in such stoves is always wasteful and will require about three times as much gas for the same heating service as would be required if the gas were used in a properly built natural-gas furnace. Even with perfect combustion in the fire pot of a coal stove or coal furnace the waste will usually be about 75 per cent, as shown in figure 6. Properly built natural-gas furnaces have a longer fire travel and much more radiating surface than coal furnaces, and are, therefore, much more efficient.

SEC. 30.—WASTE FROM EXCESSIVE HEATING.

Rooms are more healthful if kept at about 68° F. with proper humidity, yet much gas is wasted by keeping room temperatures higher. A thermostat control will greatly aid in controlling waste from this source.

A thermostat on the baker of a cooking stove is also desirable, because it will use just enough gas for the particular baking operation, without waste.

SEC. 31.—WASTE FROM USELESS RADIATION.

The baker of the ordinary natural-gas range is very poorly insulated and the radiation loss is large. Use of proper insulating material will greatly improve the efficiency.

The heat radiated into furnace rooms from the furnace, the furnace piping, and hot water and steam piping does not enter the room that is to be heated and therefore is wasted. Proper insulating of furnace piping will greatly curtail this loss.

In any gas-heating device the temperature of the combustion products where they go into the chimney should be within 100° of the air or water that is heated.

SEC. 32.—WASTE FROM DAYLIGHT BURNING OF LAMPS.

One incandescent mantle lamp burning all of the time, or 8,760 hours in the year, will consume 43,800 cubic feet of gas. Three such lamps will waste enough gas to supply an average of one domestic

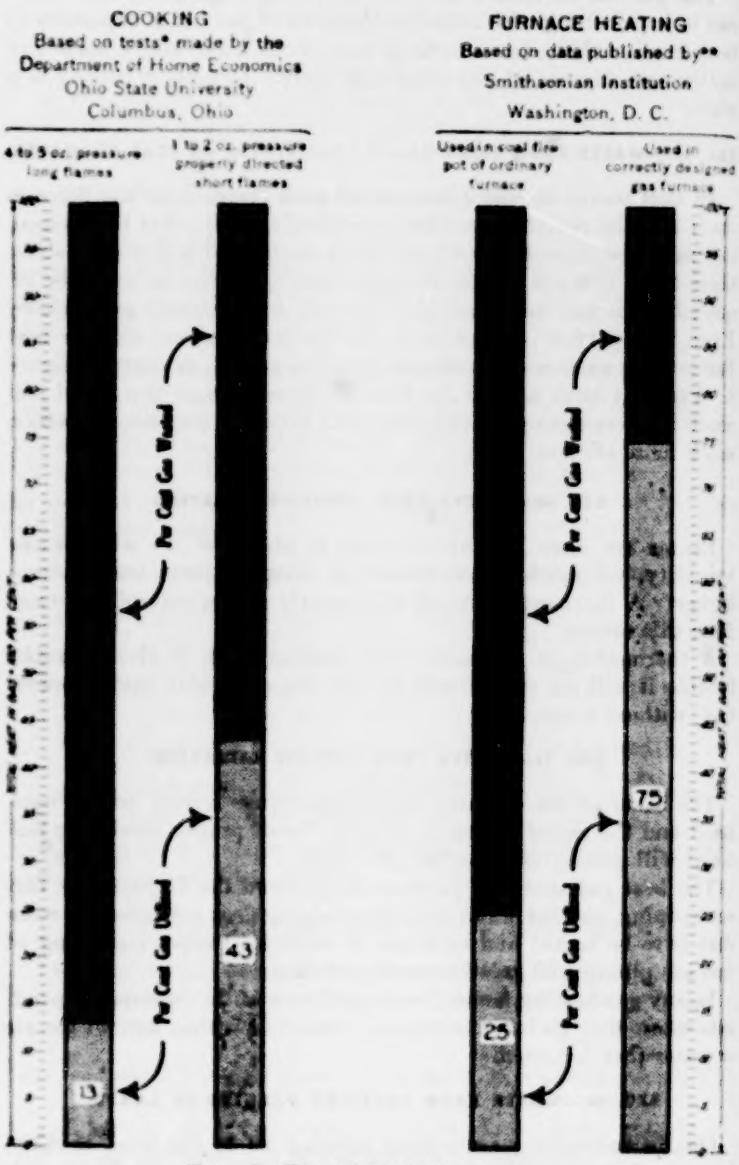

FIGURE 6.—Home waste of natural gas.

*Ohio State University Bulletin No. 28. Effect of Gas Pressure on Natural Gas Cooking Operations in the Home.

**Smithsonian Institution Bulletin No. 102, Part 7, on "Natural Gas: Its Production, Service, and Conservation."

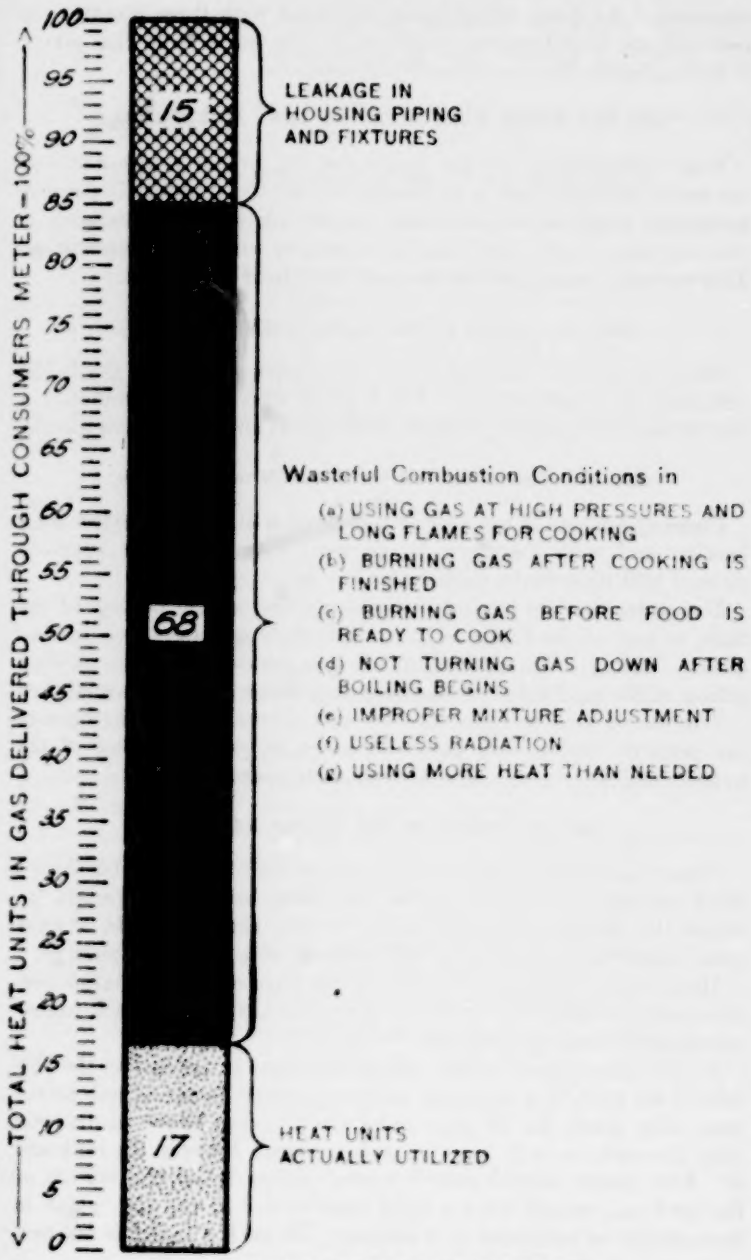

FIGURE 7.—Analysis of home wastes of natural gas.

consumer. As many street lights are fitted with three mantles per post and are kept burning continuously, the waste from this source is much greater than is ordinarily appreciated.

SEC. 33.—WASTE FROM IMPROPER LAMP ADJUSTMENT.

Most incandescent mantle lamps are not properly adjusted and use much more gas than is necessary, usually 50 per cent to 75 per cent more than would be required with proper adjustment. A hissing or roaring sound from the lamp is a sign of excessive consumption. This not only wastes gas but shortens the life of the mantle.

SEC. 34.—WASTE OF GAS IN NOT USING MANTLE.

Many people still attempt to get illumination by using gas in the ordinary open-flame burner. For a given amount of illumination a flat burner will require 2½ times as much gas as an incandescent mantle.

SEC. 35.—WASTE OF GAS WITH DIRTY APPLIANCES.

Cooking burners if not properly cleaned will give imperfect combustion and will, therefore, waste gas. Lamps if not properly cleaned will likewise be inefficient.

Hot-water heaters having the heat applied at the bottom of the tank, or any of the forms of coil or circulating heaters, require frequent cleaning. The deposition of soot, produced by the chilling action of the cold water on the flame, increases the gas consumption.

The use of grid or open tops on cook stoves, so that the burners are entirely visible, will result in more frequent cleaning of the burners and, therefore, more efficient stove operation.

SEC. 36.—WASTE IN HOT-WATER HEATERS.

Water that precipitates scale or sediment will frequently build up a thick coating on the inside of a hot-water heater and greatly increase the amount of gas necessary to heat the water. In a great many cases this scale in time will entirely close the water passage.

Most coil or circulating heaters do not have enough radiation surface and the combustion products leave the heater at a much higher temperature than they should.

In the tank type of heater, where the flame is applied at the bottom of the tank, it is necessary to have an outer jacket of galvanized sheet iron, about No. 30 gage and about 2 inches larger in diameter than the tank, so as to leave an annular space between the tank and it. This jacket should extend several inches below the bottom of the tank and should have a tight head or end at the top, which in turn should be connected to a chimney. If such a jacket is not pro-

vided the gas consumption will be excessive. However, with such an outer jacket the efficiency can be kept as high as with a coil heater.

With instantaneous heaters improper adjustment of the pilot light frequently results in excessive consumption of gas.

SEC. 37.—WASTES THAT OUGHT TO BE PROHIBITED.

(*a*) Improper adjustment of appliances, resulting in imperfect combustion.

(*b*) Low burners—that is, burners more than 1¼ inches away from the cooking vessel on cook stoves.

(*c*) Solid tops on cook stoves. Grid tops or skeleton lids only should be used.

(*d*) Use of gas in coal furnaces and stoves. Especially built gas-heating appliances, giving an efficiency of at least 75 per cent should be used.

(*e*) No hot-water heater should be used that gives an efficiency of less than 75 per cent.

(*f*) No tank heater, that is, tank with burner underneath, should be used without an outer jacket and flue connection.

(*g*) All daylight burning of lamps ought to be prohibited.

The prohibition of the foregoing wasteful uses of natural gas would—

(*a*) Greatly improve the quality of the service.

(*b*) Immediately convert low-pressure conditions into usable service for cooking.

(*c*) Cut down the needed consumption during the cold-weather period—where the demand is now greater than the available supply—so as in effect to make more gas available for all.

(*d*) Add 15 to 20 years to the period that natural gas will be available for domestic use.

(*e*) Because of the greatly increased efficiencies obtained—even with decidedly higher prices per 1,000 cubic feet—would permit the domestic consumer to get the same service without a greater annual outlay of money.

(*f*) Permit the many small towns that are too small for the introduction of manufactured gas to have gas service for a much longer period.

PUBLICATIONS ON NATURAL GAS AND INDUSTRIAL GASES.

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PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION.

BULLETIN 6. Coals available for the manufacture of illuminating gas, by A. H. White and Perry Barker, compiled and revised by H. M. Wilson. 1911. 77 pp., 4 pls., 12 figs.

BULLETIN 55. The commercial trend of the producer-gas power plant, by R. H. Fernald. 1913. 93 pp., 1 pl., 4 figs.

BULLETIN 80. Economic methods of utilizing Western lignites, by E. J. Babcock. 1915. 74 pp., 5 pls., 5 figs.

TECHNICAL PAPER 9. The status of the gas producer and of the internal-combustion engine in the utilization of fuels, by R. H. Fernald. 1912. 42 pp., 6 figs.

TECHNICAL PAPER 38. Wastes in the production and utilization of natural gas, and methods for their prevention, by Ralph Arnold and F. G. Clapp. 1913. 29 pp.

TECHNICAL PAPER 106. Asphyxiation from blast-furnace gas, by F. H. Wilcox. 1916. 79 pp., 8 pls., 11 figs.

TECHNICAL PAPER 112. The explosibility of acetylene, by G. A. Burrell and G. G. Oberfell. 1915. 15 pp.

TECHNICAL PAPER 131. The compressibility of natural gas at high pressures, by G. A. Burrell and I. W. Robertson. 1916. 11 pp., 2 figs.

TECHNICAL PAPER 158. Compressibility of natural gas and its constituents with analyses of natural gas from 31 cities in the United States, by G. A. Burrell and I. W. Robertson. 1917. 16 pp., 9 figs.

PUBLICATIONS THAT MAY BE OBTAINED ONLY THROUGH THE SUPERINTENDENT OF DOCUMENTS.

BULLETIN 4. Features of producer-gas power-plant development in Europe, by R. H. Fernald. 1910. 27 pp., 4 pls., 7 figs. 10 cents.

BULLETIN 7. Essential factors in the formation of producer gas, by J. K. Clement, L. H. Adams, and C. N. Haskins. 1911. 58 pp., 1 pl., 16 figs. 10 cents.

BULLETIN 9. Recent development of the producer-gas power plant in the United States, by R. H. Fernald. 1910. 82 pp., 2 pls. 15 cents.

BULLETIN 13. Résumé of producer-gas investigations, October 1, 1904, to June 30, 1910, by R. H. Fernald and C. D. Smith. 1911. 393 pp., 12 pls., 250 figs. 65 cents.

BULLETIN 19. Physical and chemical properties of the petroleums of the San Joaquin Valley, Calif., by I. C. Allen and W. A. Jacobs, with a chapter on analyses of natural gas from the southern California oil fields, by G. A. Burrell. 1911. 60 pp., 2 pls., 10 figs. 10 cents.

BULLETIN 31. Incidental problems in gas-producer tests, by R. H. Fernald, C. D. Smith, J. K. Clement, and H. A. Grine. 1911. 29 pp., 8 figs. 5 cents.

BULLETIN 42. The sampling and examination of mine gases and natural gas, by G. A. Burrell and F. M. Seibert. 1913. 116 pp., 2 pls., 23 figs. 20 cents.

BULLETIN 88. The condensation of gasoline from natural gas, by G. A. Burrell, F. M. Seibert, and G. G. Oberfell. 1915. 106 pp., 6 pls., 18 figs. 15 cents.

BULLETIN 109. Operating details of gas producers, by R. H. Fernald. 1916. 74 pp. 10 cents.

TECHNICAL PAPER 3. Specifications for the purchase of fuel oil for the Government, with directions for sampling oil and natural gas, by I. C. Allen. 1911. 13 pp. 5 cents.

TECHNICAL PAPER 10. Liquefied products of natural gas, their properties and uses, by I. C. Allen and G. A. Burrell. 1912. 23 pp. 5 cents.

TECHNICAL PAPER 20. The slagging type of gas producer, with a brief report of preliminary tests, by C. D. Smith. 1912. 14 pp., 1 pl. 5 cents.

TECHNICAL PAPER 54. Errors in gas analysis due to the assumption that the molecular volumes of all gases are alike, by G. A. Burrell and F. M. Seibert. 1913. 16 p., 1 fig. 5 cents.

TECHNICAL PAPER 57. A preliminary report on the utilization of petroleum and natural gas in Wyoming, by W. R. Calvert, with a discussion of the suitability of natural gas for making gasoline, by G. A. Burrell. 1913. 23 pp. 5 cents.

TECHNICAL PAPER 104. Analysis of natural gas and illuminating gas by fractional distillation in a vacuum at low temperatures and pressures, by G. A. Burrell, F. M. Seibert, and I. W. Robertson. 1915. 41 pp., 7 figs. 5 cents.

TECHNICAL PAPER 109. Composition of the natural gas used in 25 cities, with a discussion of the properties of natural gas, by G. A. Burrell and G. G. Oberfell. 1915. 22 pp. 5 cents.

TECHNICAL PAPER 120. A bibliography of the chemistry of gas manufacture, by W. F. Rittman and M. C. Whittaker, compiled and arranged by M. S. Howard. 1915. 30 pp.

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[fol 142] Q Have you the Ohio State University Bulletin, No. 28?

A I have.

Q This bulletin is entitled "The Ohio State University Bulletin, Volume 22, May 1918, Number 28, entitled "Effect of Gas Pressure on Natural Gas Cooking Operations in the Home, based on tests made in the Laboratory of the Department of Home Economics The Ohio State University, Columbus, Ohio, under the direction of Edna Noble White, Head of Department of Home Economics, Grace Linder, Instructor in Home Economics, and Samuel S. Wyer, Consulting Engineer, Columbus, Ohio, and is published by the University at Columbus. I do not remember whether you told me that any other copies were available or not?

A I can get you additional copies of that.

Mr Richardson If the Commission will bear with me just a moment until I see what portions of this I desire to offer?

Commissioner Walker Do they depend on natural gas for heating purposes in West Virginia, Pennsylvania, and Ohio, where they have natural gas or do they just use it for cooking?

A I can answer that generally by giving the relationship in Ohio. The average amount of gas consumed by the average domestic consumer in that state is 100,000 cubic feet per annum. That of course means that about fifty thousand cubic feet per annum is used, on an average, for heating. In Pennsylvania, the average consumption per domestic consumer per annum is 120,000 cubic feet. That means that in that state about 70,000 cubic feet is used for heating. In the state of West Virginia, the average consumption by domestic consumers per annum is 153,000, which means that in that state about 100,000 feet of gas is used per annum [fol 143] for heating purposes.

Commissioner Walker At the rate they adding on to these lines over the state we have got to draw the line as to what the gas may be used for.

Mr Richardson We offer in evidence that portion of the bulletin, the title of which has just been given, found on pages 18, 19, 20, 21, 22, 23, and 24, and also 25. This has some tables, or rather curves, that we would be glad to show in the record.

Mr Wyer If you want to summarize that entire series of tests, if you will include the conclusions, that will cover the high-points below.

(That portion of the bulletin offered in evidence being in words and figures as follows, to-wit:)

Sec. 29. 1. Satisfactory cooking operations on frying purposes, frying beefsteak and pan-broiling beefsteak can be carried on with 2 oz. natural gas pressure.

2. The changes in vessel position necessary to permit satisfactory operation at pressures as low as 2 oz. are easy to make and require no special changes in existing stoves.

3. Bread can be satisfactorily baked with .5 oz. natural gas pressure.

4. Natural gas stoves are not properly constructed to use natural gas efficiently at high pressures, nor satisfactory at low pressures.

5. At high pressures natural gas stoves are inefficient and therefore wasteful in their use of gas.

[fol. 144] 6. The burners on natural gas stoves are too low.

7. The holes in the spuds of natural gas stoves are too small.

8. Long flames for cooking operations are wasteful.

9. The maximum results are obtained with many short flames rather than a few long flames.

10. A strong draft of air may deflect the flame away from cooking vessel so as to seriously interfere with and in many cases stop cooking.

11. Where two flames strike each other, due to the fact that openings are too close in burner, poor combustion will result. This will produce a luminous flame which will in turn result in a smoking burner. Neither air nor gas adjustment can overcome this.

12. Drilled burners are better than slotted burners, because there is less likelihood of two adjacent flames striking against each other, therefore producing imperfect combustion conditions.

13. Natural gas stoves should not be furnished with solid stove tops since this suggests the carrying on of cooking operations on top of the stove, rather than with the vessel in the proper position.

14. At low pressures no perceptible change can be made in the combustion conditions by adjusting the air shutter. The best conditions obtained were with the shutter wide open.

15. Too much heat is used in most cooking operations, correct application is more important than mere intensity.

16. The natural gas pressures carried in most natural gas distributing plants are too high for efficient operation.

17. Meter registration is approximately correct regardless as to [fol. 145] variation in pressure. That is, meters do not run faster when the pressure is low.

18. Lowering the temperature of natural gas increases its heating value per cubic foot. Natural gas has a temperature about 25 degrees lower in the coldest month in winter than in the hottest month in

summer, and the heating value per cubic foot due to change in temperature is therefore about 5 per cent higher in the coldest month in winter than in the warmest month in summer.

19. The maximum possible variation of heating value due to variation in gage pressure would make the heating value during the low pressure periods in winter less than 3 per cent lower than during the high pressure period in summer.

20. Since the heating value increase due to low temperature of gas in winter more than offsets the possible decrease in heating value due to low pressure, the practical effect of the two is that the heating value per cubic foot of natural gas as served in the winter under low pressures and low temperature is higher than that served in the summer under higher pressures and higher temperature.

21. Variation in barometer from day to day may make more of a change in the heating value of gas than any possible variation in gage pressure.

22. Better and more efficient service could be rendered if natural gas pressures were generally lowered to probably 2 oz. rather than increased to 4 oz. or above.

23. The lowering of natural gas distributing pressures to approximately 2 oz. would produce more efficient and satisfactory operating conditions for the consumer, would greatly curtail the leakage on the consumer's premises, which is paid for by the consumer, and [fol. 146] would also substantially lower the leakage in the gas company's distributing plant.

Part II

Fundamental Principles Underlying Natural Gas Pressure Question

Sec. 10. Definition of "Natural Gas."—Natural gas is a highly combustible gas made by a secret process of nature. It is not a chemical compound—as popularly supposed—but a chemical mixture of several combustible and diluent gases and vapors thoroughly diffused—that is, thoroughly intermixed,—through each other, the number and exact proportion of the various crude natural constituents varying for the different localities and somewhat during the working lives of individual wells.

Sec. 11. What Makes Gas Pressure.—Natural gas is a fluid composed of a large number of molecules which are vehicles of energy continually in motion and having an inherent tendency to get farther and farther apart. The range of motion of the molecules is limited only by the volume of the closed containing vessel in which they constantly moved to and fro. That is, the molecules are in a state of constant bombardment against each other and against the sides of the containing vessel.

Natural gas pressure is the result of the combined efforts of all the moving molecules in the gas trying to get farther and farther apart; that is, a mass of gas enclosed in a vessel expands and fills it, and, being restrained from further expansion, it exercises a pressure against the walls of the vessel. This pressure is the same in all directions on equal areas of surface. Contracting the volume of gas increases the intensity of its internal molecular motion and therefore increases its pressure.

[fol. 147] With a given mass of gas any increase in volume of containing vessel will give the molecules more range of motion and thereby lower the pressure.

Thus, if a part of a given mass of gas is removed from a closed vessel or reservoir the remaining mass of gas will expand instanter and keep the vessel or reservoir filled, but at a lower pressure.

Sec. 12. Gage Pressure.—This is simply the pressure indicated by a pressure gage. Two general classes of gages are used for measuring gas pressure.

(a) Spring Gages.—Where the effect of the pressure exerted against some form of spring is made to move a pointer over a graduated dial or scale.

(b) Fluid Gages.—Where the effect of the pressure is indicated by the height of the column of fluid in a "U" shaped tube. One side of the "U" shaped tube is open to the atmosphere and the other is attached to the pipe where the pressure is to be measured. The gas pressure in this pipe then lowers the fluid in one side of the tube and raises it in the other. The total difference in the heights of the fluid on the two sides represents the total fluid pressures as shown in Fig. 1, page 3. When no pressure is applied to such a "U" tube gage other than the prevailing atmospheric pressure, the liquid will stand at the same level in both tubes.

The pressures in natural gas distributing plants are almost universally measured in ounces per square inch, while the pressures in manufactured gas distributing plants are measured in inches of water, 1 oz. equalling 1.73 inches of water.

[fol. 148] Where the word pressure occurs in ordinances or rules it invariably means gage pressure.

Sec. 13. Atmospheric Pressure.—Atmospheric pressure is measured by a barometer, usually in inches of mercury, one inch of mercury equalling .49 lb. per square inch pressure—and is synonymous with barometric pressure.

Sea level is the datum from which atmospheric pressures are reckoned. At that point dry air at 32 degrees Fahrenheit exerts a pressure of 14.7 lbs. per square inch.

Sec. 14. Barometric Changes Make More Difference on Total Pressure Than Gage Pressure Variation.—On account of the changing atmospheric conditions the barometric pressure of gas varies from day to day, and from hour to hour on the same day, this

during these tests the barometric pressure varied from 29.69 to 28.85 inches of mercury, the equivalent of .41 lbs. 6 oz.—or considerably more than the entire range in gage pressure.

Sec. 15. Absolute Pressure.—This is the sum of the gage pressure and the barometric pressure. Thus, if the gage pressure is 4 oz.—equalling .25 lbs.— and the atmospheric pressure 14.4 lbs. per square inch, the absolute pressure will be 14.65 lbs. per square inch, as shown in Fig. 10. This must be used in all gas calculations dealing with change of volume due to effect of pressure.

Failure to appreciate that the absolute pressure, rather than merely the gage pressure, must be used when computing the effect of pressure on gas volume, or heating value content, has been responsible for most of the misunderstanding regarding the effect of variation in [fol. 149] gage pressure on gas quality and gas service.

Sec. 16. Differential Pressure.—This is the difference between the pressure at the inlet and outlet point of a gas line. Thus, if the inlet pressure is 6 oz. and the outlet pressure is 4 oz. the differential head, or pressure, is 2 oz. In gas transmission it is the differential pressure that constitutes the effective force for pushing the gas through the line.

Sec. 17. What Makes Gas Flow.—The inherent tendency of gas to expand is the basic cause of gas flow. Gas flow in pipes cannot take place except between openings of higher to openings of lower pressure. That is, flow can be obtained only by sacrificing pressure. For this reason, it is a physical impossibility to maintain uniform pressure conditions and at the same time have gas flow through the lines.

Sec. 18. Effect of Pressure on Gas Volume.—For practical purposes, at a given constant temperature the volume of natural gas is inversely proportional to the absolute pressure,—see Sec. 15— to which the gas is subjected. That is, with a given mass of gas, if you double the absolute pressure you reduce the volume one-half, or if you double the space in which a given mass can expand you reduce the absolute pressure one half. This is known as Boyle's Law. The small change in Volume due to variation in gage pressure is shown in Fig. 11, and the table in Sec. 23.

Sec. 19. Effect of Temperature on Gas Volume.—Natural gas expands approximately 1 per cent in volume for each 5 degrees Fahrenheit increase in temperature, and contracts 1 per cent in volume for [fol. 150] each 5 degrees Fahrenheit decrease in temperature. The variation in mean monthly temperature of natural gas at Columbus, Ohio, is shown in Fig. 12.

The variation in temperature of natural gas in the underground mains makes more difference in the heating value than the variation in gage pressure. The maximum fluctuation in temperature producing a difference in heating value of about 5 per cent while the maximum fluctuation in pressure produces a difference in heating value of less than 4 per cent. Furthermore, these variations work

in opposite directions. That is, in winter time when the pressure is low, therefore tending to decrease the heating value, the temperature is low, tending to increase the heating value. This increase due to low temperature will always be more than the decrease due to low pressure.

Sec. 20. Standard Conditions.—Since the volume of a gas varies with the temperature and pressure, in order to secure comparable results in gas calculations, and the establishment of standards, a standard condition is necessary. This is usually taken at 32 degrees Fahrenheit and a pressure of 29.90 inches of mercury.

Sec. 21. Heat Unit.—The unit quantity of heat, or the heat unit, is the quantity of heat required to raise the temperature of a unit weight of water one degree. Different kinds of units in use are as follows. The British Thermal Unit—B. t. u.—is universally used in America in engineering work. The calorie is universally used in food problems; where used elsewhere it has been customary to use the expression "large calorie" to distinguish it from the small calorie. The gramme calorie, or small calorie, is universally used in scien- [fol. 151] tific work.

British thermal unit, abbreviated B. t. u., is the heat required to raise one pound of water one degree Fahrenheit.

Calorie.—This is the amount of heat required to raise one kilogram of water one degree Centigrade.

Gramme Calorie.—This is the amount of heat required to raise one gramme of water from zero Centigrade to 1 degree Centigrade. The arithmetical relation of these three units is as follows:

B. t. u.	Large calorie	Gramme calorie
1	0.252	252
3.9682	1	1000
0.003968	0.001	1

Sec. 22. Heating Value.—This is the number of heat units that are evolved by the combustion of a unit weight or volume of fuel. The terms "calorific value," "calorific power," "heating power," "thermal value" and "heat of combustion" are frequently applied to the same phenomenon.

Q. This text does not refer to this, but I will ask you: assuming that you have 1,000 cubic feet of gas at atmospheric pressure and trace a curve to an 8 oz. pressure. That is correct is it, that is, I am stating it correctly?

A. Yes.

Q. Now what does that curve indicate as the difference?

A. It means simply this. If as a matter of comparison you have at atmospheric pressure, 1,000 B. t. u. in a cubic foot of gas, and you increase the pressure so that you have another cubic foot at 8 oz. pressure, the relative B. t. u. contents of the two cubic feet, the one at atmospheric pressure, and the other at 8 oz. pressure, will be [fol. 152] that the one at the 8 oz. pressure has 3.4 per cent more

B t u than the one at atmospheric pressure. And the relative graduation of pressure running from atmospheric to two ounces follows the same line, and is comprehended within those extremes. Practically a straight line.

Q. Now I wish to have the reporter to take that portion of this page 25, which I have introduced in evidence, under paragraph 23: "Effect of Pressure or Temperature Changes on Heating Value of Gas." These will produce changes in volume, but will neither destroy nor create any heat units, and hence will neither increase nor decrease the total number of heat units contained in the gas. However, the volumetric changes will always alter the distribution of the total number of heat units as follows:

Gage pressure above atmosphere	Relative B. t. u.	Relative per cent
8 oz.	1034	103.4
7	1030	103.
6	1026	102.6
5	1022	102.2
4	1017	101.7
3	1013	101.3
2	1009	100.9
1	1005	100.5
0	1000	100.

A. I would like to add here by way of explanation, because the point comes up so frequently and is responsible I think for most of the misunderstanding in regard to the effect of pressure on gas volume. Most of the text books used in teaching physics in High Schools and Colleges are not as explicit as they should be with regard to a very simple arithmetical principle, namely Boyle's Law. Boyle's Law always uses absolute pressure. That is, the barometric pressure plus the gage pressure. A great many of the incorrect statements that have been made with regard to the effect of pressure on gas [fol. 153] volume have been made because the persons making them did not appreciate that simple arithmetical principle. That the word pressure, in Boyle's Law, refers to absolute pressure, which is the sum of the barometric pressure and the gage pressure, and you can easily see the effect of that. Assuming a barometric pressure of 14.4 pounds per square inch for Oklahoma City and a gage pressure of 4 ounces, or .25 of a pound, the absolute pressure then is 14.65 lbs. Now the relationship between 4 ounces pressure and atmospheric pressure is the relationship between 14.4 pounds per square inch, and 14.65 pounds and that is the relationship which was used in developing all of the different tables that have been introduced in this record.

Q. Mr. Wyer, did you attend the conference which was called by Secretary Lane of the Interior Department in Washington for January 15th, 1920?

A. I did.

Q. Ask you to state whether or not you know that during the months of November and December, 1919 the shortage of gas was

confined to the Oklahoma Natural Gas Company, or whether or not it was Nation-wide?

A It was nation-wide. The month of December show—I don't know what your local weather bureau will show locally, but speaking generally for the entire natural gas fields of the United States, it was the coldest month for many years.

Q Just in that connection I have an article in a newspaper which advocated a reduction in the price of gas because it was not furnished in adequate quantity, and under that is the statement that this was the coldest in 29 years.

A In some of the other towns where I have made an actual check [fol. 154] the ratio was as high as 42 years. That it was the coldest in 42 years.

Q Now all large natural gas companies in the United States, who have to transport their supply for long distances, as I understand you, experienced a shortage during that period?

A They did.

Q I want to ask you whether or not the business of furnishing natural gas to the public is a more hazardous business than other public utility business in which a person could manufacture his service?

A Very much more so. In fact the hazard in the natural gas business is greater than in any other public utility service.

Q Explain why that is true, and what you mean by hazard.

A The term "hazard" as used in the previous answer refers to the risk assumed by the man or men who invest money in order to develop natural gas resources. The biggest and most unappreciated factor in the entire natural gas industry in the past, and today, is and has been that there are very few natural gas executives that have any conception whatever as to what the small word "cost" means. Most of the gas that has been sold in the past, at least within the last five or ten years, has been sold below cost. By cost I mean taking care of the cash expenditures that must be met to keep the property going, and also the liabilities accrued to keep the property value intact. On the basis of a very general investigation of the industry in governmental work, and on the basis of a large number of private investigations in strictly private professional work, it is my judgment that at the present time the great industry is stared in the face with the fact that at least 75% of the natural gas industries in the United States will be insolvent in less than [fol. 155] three years time unless there is a radical rate readjustment. That, therefore, is one of the most conspicuous hazards of any enterprise. People have put in their money and the chances of getting that money back are very remote, and in a number of instances, probably impossible.

Q What would you say Mr. Wyer, of the condition of the Natural Gas Company which, in the year 1917, spent in new lines $974,473.09, which expenditure was not made out of the earnings but was new money put into the business by its stockholders, and whose net earnings that year, after paying their operating expenses was only $78,767.09?

A. I would say they were optomistic to the nth degree.

Q. In other words, that Company put in nearly nine hundred thousand dollars more than its total net earnings, and not counting that nine hundred thousand dollars as a part of the expense. What would you say of a natural gas company that in 1918, following that expenditure in 1917, just mentioned, spent $1,632,000.00 in extending its lines, and that $1,632,000.00 was money subscribed by its stockholders, and was not paid out of earnings, and whose net earnings amounted to about $225,000.00?

A. They had more optomism than business judgment.

Q. What would you say if that same gas company, in an effort to secure and furnish an adequate supply of gas in 1919 spent about $1,419,000—$1,419,667.00 in building pipe lines, $60,000.00 in building a compressor station, and $300,000.00 in distribution equipment, and that was new money, not paid out of earnings, and that its total net earnings over and above its operating expenses, not counting that investment as any part of the operating expenses, was only $1,143,000.00?

A. Of course it does not require any particular stretch of imagina-
[fol. 156] tion to figure out that the time for that sort of pyramiding will terminate in bankruptcy in the very near future unless there is an entire readjustment in the financial situation.

Q. Assuming that they have expended that money, their total expenditures for pipe lines during those three years were $4,086,145.00, and their total net earnings, and by net earnings I mean their net income after operating expenses, not counting that expenditure as any part of the operating expenses, during that same three years was $2,148,120, being an expenditure of $1,438,024.00 more than its net earnings were in those three years, in an effort to procure and furnish an adequate supply of gas. If they exercised reasonable judgment in the places to which they would lay their pipe lines in an endeavor to get a reasonable supply of gas, would you say they were or were not diligent, or that they were or were not negligent, in undertaking to furnish an adequate supply of gas?

A. I would say they were very diligent in spending their money. They spent more money than the engineering facts under that situation would warrant.

Q. In going to a new gas field, where gas has been found and where the open flow volume of the wells showed that they are large, and the conditions are such that no gas has ever been used out of the field so that nobody could know what the life of the wells would be, if the company places its pipe line to this field, and the wells shortly thereafter go down in volume and pressure to where the quantity obtainable is negligible, ought the gas company, under all of the facts be charged with reckless expenditure because they thought that field would be lasting and built a line there?

[fol. 157] A. No.

Mr. Fulton. If the Commission please, I assume the Commission will pass on those questions themselves. For that reason it is simply taking up the time of the Commission to take the testimony of the

witness on such matters as that, if that is for the Commission to pass on, it is not a question of expert testimony.

Commissioner Walker. This is the most liberal court in the world. We let it all go in and then check it up and throw out the bad and leave in the good.

Q. Does a reduction in the supply of gas belonging to a natural gas company, legally, or economically, or in fact, look to an increase, or a decrease in price for the gas which the Company must sell?

A. Increased price for the very simple reason, and it is a reason that most natural gas executives have not appreciated, that about 70 per cent of all the cost pertaining to the production of natural gas are absolutely fixed without any regard at all to the volume of business handled, and as the volume decreases, very obviously the unit of cost must increase.

Q. Do you know whether or not there is such a thing as a Gas Company like the Oklahoma Natural Gas Company which has long pipe lines, and which uses compressor stations for the purpose of, pushing, or passing gas through those pipe lines, put air in those pipe lines and sell it for gas?

A. I have made many investigations of the popular indoor sport of charging a natural gas company with putting air into the gas and have never found a single instance where there was one single scintilla of evidence to support such false statements.

[fol. 158] Q. When the consumer has a flickering flame, and the flame goes out, is that any evidence that air has been put in the gas?

A. None whatever. It is evident that he has not his appliances adjusted properly, or that there is not enough gas at the mixer to make it come up through the burner.

Q. It might be evidence that his burner was mixing too much air for the amount of gas, might it not?

A. Yes, or with a high pressure, four ounces, or thereabouts, of actually blowing the flame out, giving a hissing sound and blowing the match out because you cannot burn gas unless the air is mixed with it. You cannot burn straight natural gas. Straight natural gas will blow out a match. If the burner is too high, as you see in the description, you may get an actual condition that will give the impression that there is air in the gas when the fact is you are using high pressure, raw gas.

Commissioner Walker. One of the most common complaints that come to the Commission is that as the pressure goes down the meter speeds up?

A. That is untrue.

Q. That there is found to be air coming through, that they watch the meter speed up and there will be gas enough to just flicker, or be a little tip of a flame.

A. That is because they are using too high pressure, or using gas without a proper adjustment of the mixer.

Commissioner Walker: We had one case where he said he disconnected his pipe but the meter kept on going.

Mr. Richardson: He may have had a leakage.

Mr. Wyer: The ordinary consumer, when he is not burning any gas, that is, when his fixtures are shut off, will, in the course of [fol. 159] a year, waste fifteen per cent of the gas that would ordinarily pass through the fixtures, through leakage of the fixtures.

Commissioner Walker: That is plumbing around the house?

A. Yes. Let's say one foot an hour, and there are 8,000 hours in a year, and the leakage of only 1 foot an hour would give you over 8,000 feet of gas in the course of a year, and that would be 8% of the average consumer, domestic consumer's consumption. The best data we have indicates that it is about 15 per cent of the gas passing through.

Mr. Richardson: Mr. Wyer, in talking about the complaints of consumers about the size of his gas bill in winter weather, it is a complaint that the meter registers more than they use. I believe you state that is not true?

A. It is.

Q. If it is true, it is an individual case where the meter needs adjustment?

A. Certainly.

Q. There seems to be a conception also that the same amount of gas consumed in the winter time ought to perform the same work, or generate the same heat and give the same effective heat as that amount of gas in the summer time, or in the spring, or fall. Will you explain to the Commission what the facts are in regard to that?

A. Of course in the summer time the gas is used primarily for cooking, and heating hot water tanks only. In the winter time of course it is used for those two functions, and heating as well, and in making a comparison merely between hot water heating and cooking in summer, and winter, you have these influencing base differences which is responsible for a large part of the mis- [fol. 160] understandings. In the first place, most cooking operations start somewhere along the line in heating a given amount of water. The tap temperature of water in the summer will be usually thirty or forty degrees higher than in the winter time. So we find that even in heating water and in cooking operations considerably more heat would be required in the winter time. For instance, to heat a kettle of potatoes, more heat would be required in the winter time than would be required to heat the same potatoes in the same kettle in the same amount of water in the summer during the higher temperature of the water. A very large percentage of the fats that are used for instance in frying operations will be especially cold in winter and you have the same difference in temperature. As far as the hot water heater is concerned, the hot water heater in the summer time has considerably less work to do to deliver a given amount of hot water in to the bath room or the wash boiler than in the winter time, and in addition to these two groups of facts that I have mentioned, you have this secondary feature to contend with,

namely, the radiation loss in winter time when your kitchen is cold is very much larger than it is in the summer.

Q. Now carrying that same idea further, Mr. Wyer, and bearing in mind the general impression of the general consumer, suppose he wants to heat his house in the spring, when the mean temperature of the atmosphere, we will say, is about 50 degrees and he wants to bring it to 70. He lights his gas burner, or furnace, and he burns a quantity of gas that is sufficient to bring the house up to a temperature of 70. Now he has an idea in the winter time if the temperature is zero, he should heat his house and bring it to 70 [fol. 161] degrees with the same amount of gas?

A. In your first illustration he raises the temperature of the air in the house 20 degrees, and in the next he raises it twice that much.

Q. And the gas has more work to do and it requires more gas to do it?

A. Correct, and not only that, but in the winter time you will have a larger percentage of cold days and windy days which makes the heating problem very much more difficult than a cold day for three reasons. In the first place the average house, and that is especially true of the houses in the Mid-Continent field, are very poorly constructed. You have many more houses here that do not have a tight basement than in the East.

Q. That is because ordinarily our weather does not require it.

A. Yes. There are relatively few weather-stripped houses, and therefore the ordinary house in the Mid-Continent field is, from a heating viewpoint, merely a heat sieve. That is, it is very much easier for the wind to get in than in a well built house, and if it does get in it will bring some of the cold air from the outside into the rooms, therefore increasing the demand on the heating device. Second, on windy days, if your damper is not adjustable in your heating stove, you may get an abnormally strong draft, and although you may have plenty of gas you will find that the most of the heat is going up the flue. A changing of the chimney damper will correct that. As far as cooking is concerned, very frequently a strong draft will so deflect the flame that instead of going straight up from the burner it will turn off at an angle of 45 degrees and thereby prevent cooking operations although the gas is being burned, and the meter [fol. 162] is registering what passes. Merely correcting the draft situation in your cook stove would remedy the situation.

Q. Is the leakage, in your estimation, on any pipe line or distributing system, more or less at high pressure or low?

A. It is more at high pressure than at low pressure because of the loss of gas flow, and there is a practical reason why, even though you cut down your pressure so that according to the loss of gas flow you would halve your leakage—that is, cut the leakage 50%, such a reduction in pressure will decrease the leakage very much greater for this simple reason. Pressure in the neighborhood of 4 to 5 ounces on a gas main is so strong that with the average soil covering where you have a gas leak, the gas will work its way through the soil to the surface. On the other hand, a pressure around one to two ounces is so much less powerful, so far as its penetrating feature is con-

ceived, that even though you could have a hole in your pipe the soil may be compact enough to hold that in. In fact, in making investigations for electrolysis of gas lines that is, disintegration due to the chemical action of current from electric street railways that have leaked from their own circuits, we have found in a number of cases in clay soil where they carried low pressure, that the pipe was entirely gone and you had practically a conduit through the clay, and yet there was no leakage on the surface and the leakage only became obvious in each case after a very heavy thunder-shower which softened the ground and permitted the gas to work through. So the matter of lowering the pressure is especially important from the viewpoint of conserving gas and cutting down loss in the distributing system.

[fol. 163] Q Mr. Wyer, there may be some statement you wish to make about some matter that I have omitted to ask you. If so, you are at liberty to make it.

A I have none to make.

Mr. Richardson. You may cross-examine.

Cross-examination.

By Mr. E. L. Fulton, assistant Attorney General:

Q Just one or two questions I would like to ask for my own information. In common phraseology, what is a foot of gas?

A There is no such thing as common phraseology in which to answer that question.

Q I mean explain it so the average person would know what that is?

A To the lay mind, a foot of gas would mean the amount of gas that could be placed inside of a closed receptacle, the individual volume of which would be one cubic foot. That would be regardless as to the shape of that volume because of the distinguishing characteristic of gas which is that it expands and completely fills an enclosed space.

Q Does that take into account any pressure?

A If you take into account pressure, then of course you must take into account temperature too, and remember that in engineering conditions, that a cubic foot of gas is the amount of gas completely filling an enclosed space having an individual volume of one cubic foot, and where the temperature is of some assumed point, and where the pressure is at some assumed point, known in engineering parlance as a standard condition, and that standard condition is the bench mark to which all their gas calculations refer. For instance, the standard for cubic foot is not the regular cubic foot as you would have here, but the pressure at sea level and usually a temperature of [fol. 164] 60 degrees Fahrenheit. To illustrate. For instance, I think I can get it so you will see it from a legal viewpoint. Assuming you had a controversy as to what one cubic foot of gas meant here locally, in the absence of any specific specification to the contrary any court would undoubtedly follow the standard used by the United

States Bureau of Standards, namely, that a foot of gas is an amount of gas, one foot in volume, sea level pressure, and 60 degrees Fahrenheit.

Q. What is it at any other pressure than atmospheric pressure?

A. You can specify anything else you want. I am giving you what the Bureau of Standards have defined.

Q. Does each company establish its own unit of measurement?

A. In buying gas in the field, gas is usually purchased on some definite pressure above atmospheric, say four or 8, and I believe there is some gas purchased at one pound, or a pound and a half. That is owing to the atmospheric pressure at that particular point.

Q. Is there any atmospheric pressure in gas if it is in a container?

A. There is.

Q. It has the same pressure there as outside?

A. Yes, that is the container has to be at atmospheric pressure.

Q. There is no set rule, then if I understand you, adopted by the different gas distributing companies when they put out their meters as to what constitutes a cubic foot?

A. Most of those meters are run through a prover at a definite pressure that varies with different companies. Of course gas is not used for proving gas meters. We use air. Air acts just the same as gas there, and as a matter of economy and also safety, air is passed [fol. 105] through at some fixed gage above atmospheric pressure.

Q. For instance, if a person or distributing company should purchase gas and should fix the measurement of a foot of gas at four ounce pressure, they could establish their own unit of measurement when they go to sell it, and sell a foot of gas and yet not sell as much as half a foot of gas?

A. No. Oh no. Get rid of that one-half idea. You start in at four ounces and drop down to atmospheric pressure and you have changed the volume a very negligible quantity as all these different combinations of figures in the record will show. I can give you the exact figures.

Q. I understand your position, I had another thought in mind.

A. The difference between 4 ounces and atmospheric pressure would be 1.7 per cent.

Q. What is a heat unit?

A. A heat unit is the quantity of heat required and used to raise a unit weight of water a unit degree of temperature of which there are several distinct types. The definition I have given you is a generic one. A British Thermal Unit, abbreviated B. T. U. for a short definition which will answer our purpose, is the amount of heat required to raise one pound of water one degree Fahrenheit. The Calorie which is the definition used in all scientific work is the amount of heat required to raise one gramme of water one degree Centigrade. It is also known as the large Calorie, and the Gramme Calorie, and it is used in all food calculations, notwithstanding all laboratory tests of food are merely the recorded tests that go out to the public on food values and are what is known as the large calorie which is the amount of heat required to raise one kilogram of water one degree Centigrade. The large calorie is 1000 times larger than

[fol. 166] the small. The calorie of food is in round numbers, four times as large as the British thermal unit.

Q. Well, I got part of that.

A. Well, let me give you one more comparison. The heat unit is merely the engineer's yard-stick for measuring heat as the dollar is the public yard-stick for measuring industry.

Q. All natural gas has the same quantity of heat units?

A. No sir, it varies at different places, for different wells in the same field, and during even the working life of an individual well.

Q. Would there be any way that you could tell how many heat units there would be in a thousand cubic feet of gas?

A. Yes.

Q. How many would there be?

A. By making a test by means of a calorimeter, or by an analysis of the gas.

Q. You could not tell off-hand?

A. No sir.

Q. Would the number of heat units vary to any material extent according to the pressure?

A. It would.

Q. To what extent?

A. Just the same relationship that pressure affects the volume. Changing pressure does not create nor destroy any heat units, but merely squeezes them together. You increase the pressure and it squeezes them closer together. For instance if we had before us a cubic foot of feathers, we could take those feathers and squeeze them down to one half a cubic foot, and still have the same number of feathers. The same amount, but it would be compressed into smaller space. That is precisely what happens in gas, and that [fol. 167] is the reason that I, and all engineers who work to any standard, and all public utility commissions, when they attempt to set any standard for gas, either natural or manufactured, they always refer to the B. t. u., or some standard condition as a bench mark.

Q. I want to ask you again. You told me, but I have forgotten it, the difference in the amount of gas, any take a cubic foot of gas at four ounce pressure, and one at atmospheric. What do you say the difference was?

A. 1.7 per cent, and I think when I read that a few minutes ago I read the wrong figure. I read it 1.5 per cent. It should have been 1.7 per cent.

Q. Now let's see if I understand what you mean. That is 1.7 per cent less amount of gas in that cubic foot of gas at atmospheric than there would be at four ounces?

A. Let's state it this way. Start it with atmospheric pressure and 1000 B. t. u. in a cubic foot of gas. That happens to be just about what the facts are.

Q. 1000 heat units?

A. Yes, that is the average for natural gas in the United States. That is close enough for our comparison. We will now squeeze that foot of gas by increasing the pressure to four ounces. We are either

going to do one of two things. We will have to add some additional gas to keep our cubic foot at higher pressure, or we will have the same quantity of gas at a higher pressure and a smaller volume. Now what actually will happen is that if we keep the same size container and want to increase the pressure, we must add, in going from atmospheric pressure to four ounce pressure, 1.7 per cent of gas. That is the quantity of gas at four ounces is 1.7 per cent more, in round numbers than it is at atmospheric pressure.

[fol. 168] Q. For each foot?

A. Yes, and the B. t. u. contents would vary in the same proportion and be there, and bear in mind that natural gas or any gas for that matter, although it is invisible and not perceptible to the ordinary senses, is a very definite and very tangible thing. For instance, natural gas weighs about 50 pounds per 1,000 cubic feet.

Q. Let me see if I can get that in my mind—what I was trying to get at is what is the difference between the volume and the heat units of a cubic foot of gas at atmospheric pressure, and one at four ounce pressure. I understood you to say 1.7 less for atmospheric pressure.

A. Let me start all over again. Start with one cubic foot of gas at atmospheric pressure. That is in round numbers 1,000 B. t. u. in that foot of gas. You do not add any more gas. You have the same number of heat units but you have got that gas squeezed up there under that additional pressure of four ounces, and that cubic foot still stays there, but its volume instead of being 100 per cent, is only 98.3 per cent, or 1.7 per cent less.

Q. Does it have the same number of heat units?

A. Yes. Pressure never increases nor decreases the number of heat units in an amount of gas. It merely determines the intensity of the pressure, and that determines the number of heat units in a unit of volume. For instance, take this, starting at the other end you may get it easier. If you had 1,000 heat units at 4 ounce pressure and you expand that to atmospheric pressure, you still have the same number of heat units, but if you had for instance 1,000 cubic feet at 4 ounces you would have 1,017 cubic feet at atmospheric pressure, with the same number of B. t. u.'s in that amount of gas.

[fol. 169] Q. I think I get your point so I understand it. Now another thought I did not catch clear, or see if I did. If I understood you correctly, you stated the average loss by reason of waste and inefficient appliances, was something like 80 per cent?

A. Correct.

Q. And if the consumer of gas would use proper methods and proper appliances, they would reduce their gas bills about two thirds?

A. You can make one foot of gas do the work of three with proper utilization.

Q. That would result in cutting down the revenue of the gas company to the same proportion would it not?

A. Yes, and it would immediately result in raising the price of gas.

Q. So it is no benefit to the consumer, no matter which way it goes, he pays the freight?

Mr. Richardson. They could supply more consumers.

A. There is no possible conservation until gas is made worth saving. Your statement that it is of no benefit to the consumer is untrue for this reason. Every natural gas consumer is interested in continuing the supply as long as he possibly can. I hope I have made myself clear, that when natural gas is gone you will immediately pay the equivalent of $2.00 per thousand for your natural gas. If you will make your gas worth saving, you can add from fifteen to twenty years to the life of natural gas thus pushing that period of time when you have got to go to the higher priced fuel that much further ahead. The whole conservation problem is this. The consumer by making gas worth saving can get the same cooking, lighting and heating service for the same cash outlay. Is the consumer [pg. 170] willing to meet the natural gas company on that basis? If they are not, natural gas for the state of Oklahoma is doomed. It is up to the public as to what they want to do.

Q. The question I was trying to bring out is the only result of a conservation idea would be to prolong the use of gas?

A. Yes.

Q. It doesn't mean that the ordinary consumer is going to get any more gas than he is getting now?

A. No, he will get less.

Q. But he will pay more for it?

A. Yes sir, per thousand, but your bill for the year will be no more than for the same service.

Commissioner Walker. It doesn't take as much of it used in that way to do the same work. Here is the point that gets me. Suppose we do that and then you don't have enough to go around?

A. (Continued.) You have got to face this fact, namely, that the time will come when all these plants if they operate at all, will operate on practically a manufactured gas basis. That is instead of selling on the average of 120 to 150 thousand feet per annum to domestic consumers, you will cut that down to forty, or thirty. You cannot avoid that. When you go to manufactured gas, the consumer, for gas not having over one half the heating value, will not go over twenty-two, or five thousand feet of gas, because that happens to be the average, and then the fundamental relationship is absolutely true, it makes no difference what the price per thousand for gas is, whether it is ten cents or one dollar a thousand, the annual bill of the average consumer will remain the same. The average of two million four hundred thousand domestic consumers in the United States is about thirty dollars [pg. 171] and it will remain at about thirty dollars when gas is a dollar a thousand.

Mr. Fulton. I wish I could get mine down to thirty dollars a year.

Commissioner Walker. Do you mean thirty dollars a year?

A. Yes sir, the average for domestic consumers is thirty dollars a year.

Commissioner Walker. The usual complaint is that "we have been entirely without gas, but our bill is higher than ever."

A. Any statement that they have been entirely without gas is absolutely untrue.

Q. Your testimony, and this demonstration that took place down in the dining room was connected merely with a cooking range. That is only a small part of the gas that is used by the average consumer?

A. Yes and it creates about 90 per cent of your complaints.

Q. But it doesn't create 90 per cent of our bills. You don't mean to say that 80 per cent of the loss can be made up in the cooking range?

A. The efficiency of that natural gas stove used down stairs as ordinarily used at four ounce pressure is about 13 per cent. Every dollar's worth of gas it uses at four ounce pressure 87 cents worth is thrown away. Take that stove and raise the burners, and adjust the mixers and you can get the same service with proper use with one third of the amount of gas burned.

Q. This is the point I was bringing out. In my home for the cooking range, of course I don't know what it would be for the range alone in winter, I know it would be a little more than in summer, [fol. 172] but in the summer, when we don't operate our furnace, the average bill is not over a dollar a month.

A. At what price per thousand?

Q. At thirty cents a thousand, I think, or forty, which is it?

Commissioner Walker. Forty.

Q. (continued.)—but when we have the furnace on it runs as high as thirty dollars a month.

A. What kind of a furnace?

Q. I don't know the name of it, it is an ordinary gas furnace. We have two or three gas stoves and also the furnace, but what I was bringing out is that the heating of our home costs many times more than the cooking.

A. The ordinary use of natural gas in ordinary heating appliances such as is generally used, wastes 75 per cent of the heat energy. The heating devices I have in my home wastes only 20 per cent. It is entirely feasible and possible for other people to put in proper heating appliances, but they will not put them in until the gas is made worth saving.

Q. That is the only point I wanted to bring out. I wondered if you had any suggestion to make?

A. The only thing to be done in regard to heating is to burn your gas, that is get perfect combustion, which is possible, and then to get that heat into the surrounding air, or steam or water, that you may be heating. When you have done that you have done all you can. In extreme cold weather there may not be enough gas available for the consumers, and the amount available will decline from year to year until you will ultimately get down to practically a cooking, heating hot water heaters and incidental heating purposes.

Q. It would not decline, would it, if we keep on finding more gas. That is on the assumption we will not find any more?

[fol. 173] A. Yes, but all present indications are that the increase

in the number of domestic consumers will at least equal any now known possible increase in the gas supply.

Commissioner Russell: We have had with us today a consumer, and he would like to ask a question. Mr. Rogers.

Mr. Rogers: I would like to know what kind of gas this is that we are using. Is it casing-head, or is it mixed?

A. I cannot tell you.

Commissioner Russell: We are not using casing-head.

A. Good conservation in the state of Oklahoma would require that all casing-head gas that now goes into the air should go into public utility plants after the gasoline has been removed. The blowing of denuded gas into the air is a waste and it should be put into public utility plants and sold.

Commissioner Russell: If you mean does this gas come through a casing-head plant, it does. It comes through a plant where they extract the gasoline.

A. That is what I thought. You are saving all casing-head gas now?

Commissioner Russell: Yes.

By Mr. Rogers:

Q. Well we understood you to say a little while ago that there wasn't any air in these lines, and I say there is, and we are paying for a certain portion of air.

A. If you think there is any air in natural gas, why the easiest way is to draw a sample from the supply line and have a chemical analysis made and if there is an excessive amount of air there will be an excessive amount of oxygen.

Q. All I can do is to tell what little I know. I was raised up among the Indians and didn't get much education, most of mine was with the sledge, pick, hammer and saw, and such as that, but over in the oil fields there is wells here, and everywhere?

[fol 174] A. Yes.

Q. And they have pumping stations, pumping this gas?

A. There is pumping stations, and compressor stations.

Q. Taking the gas from the wells, pumping stations?

A. Yes.

Q. They pull with terrible force, pulling the gas from the wells to the station. Now in the line from the station to the well, once in a while there comes a leak.

A. Yes.

Q. Now in place of gas leaking out at those places, air gets in, and lots of it. This air is sent on to a gasoline station and I don't know whether they take it out there or send it on with the gas or not?

A. Any air that would leak in, assuming that your statement of fact is correct, that you have an intake line from a compressing station where the intake line is at less than atmospheric pressure, and that has a leak, and if there is such an opening, then your statement is true that air would get in. The percentage of air that

would get in a small leak like that could not be determined by any chemical analysis.

Q. I helped repair those leaks, put in about 12 years at it, and if a pipe breaks off, or a joint is broken, occasionally a wagon breaks off a pipe there, makes a leak, and there is an awful sight of air gets in.

A. Your term is very misleading.

Mr. Richardson: Did gas leak out of those leaks, you said you helped repair them?

Mr. Rogers: Yes I helped repair them.

Mr. Richardson: Was gas leaking out of them?

Mr. Rogers: No sir, the air was going in and going on to the gasoline station.

[fol. 175] Mr. Wyer: The general use of vacuum in all of the intake lines, and all casing-head plants in the state of Oklahoma with ordinary prudence in operation, assuming that all of those lines are at less than atmospheric pressure, all the air that could leak in under that unusually abnormal condition, considering the normal large volume of gas you are using, running into the hundred million feet, it would be so small that a chemical analysis would not detect it. However, if in a particular case you had an entire line open, and had that line at less than atmospheric pressure, air would get in and mix with the gas.

Mr. Rogers: One of those places over here on the eastern side the objections got so strong that they got to cutting out the gasoline plant because they were sending on too much air. That was close to Ochelata, Oklahoma. I spent about twelve years working in that field.

Mr. Fulton: What effect does extracting casing-head gasoline have on it?

Mr. Wyer: Now you are getting two terms mixed.

Mr. Fulton: I may not be expressing myself intelligently.

Mr. Richardson: Just a moment. You spoke about Ochelata as being the place where you had that experience?

Mr. Rogers: Yes sir.

Mr. Richardson: That has nothing to do with the Oklahoma Natural Gas Company.

Mr. Rogers: That may be, but they make gasoline up there——

Mr. Richardson: You don't contend that the Oklahoma Natural Gas Company has any line around Ochelata?

Mr. Rogers: I don't know where their lines are, but it is that [fol. 176] was any place in the field.

Mr. Richardson: Excuse me for interrupting, but I wanted it understood that we had no line into the field near Ochelata.

Mr. Fulton: You may go ahead.

Mr. Wyer: There are two kinds of natural gas. Dry gas, and wet gas. The wet gas is what is more generally termed in the field, "casing-head." The dry gas carried only a very small part of gasoline vapor. The casing-head, or wet gas, carried a very large percentage. As petroleum comes from the ground, it comes up in four

distinct forms. Solid, liquid, vapor, and gas, all four intermingled. When you remove the gasoline you are not altering the quality of the gas. You are merely separating two of the constituents. The gasoline, in vapor form, as it travels through a line will give you line trouble. It will increase the labor on pressure meters and will greatly interfere with the continuity of service. Therefore, very little of it will get to the consumer's premises. If gasoline vapor did get to a consumer's premises, the ordinary furnace or appliance would not handle it efficiently. Gasoline vapor in natural gas will result in carbon deposits on the mantels; the use of gasoline vapor ridden gas in a cook stove will result in the smoking of the cooking vessels so that the ordinary consumer's appliances is not adapted to handle the vapor. Therefore, from a service view-point, it is very much better to have the gasoline, which belongs to and is a part of the oil, and has no connection whatever with the gas except that the two happen to be intermingled and frequently mixed together due to the same extent of temperature and pressure, it is very much better that the gasoline should be removed at one place, because by [fol. 177] so removing it you improve the quality of the service and at the same time do not remove anything from the gas which the consumer is interested in.

Mr. Fulton: Does not change the number of heat units?

Mr. Wyer: Take a mixture of gasoline vapor and natural gas, and the separation of the vapor from the gas will ordinarily change the heating value, lower the heating value of that mixture about two, to three per cent, but bear in mind that mixture never gets to the consumer in any great extent, and what did get there was a detriment rather than a service. Now with regard to the casing head, the yield of gasoline is very much greater. Very, very much greater, and no general statement can be made, but all of the residue gas that is left after the gasoline has been separated from this mixture of gasoline vapor and gas, should be saved. Good conservation will require that gas be made worth saving, and that this residue gas should be put into public utility lines wherever possible, and used.

Mr. Fulton: In other words, if I catch your thought, in extracting this gasoline from casing head gas they waste a great deal of gas?

Mr. Wyer: In a great many places. I cannot answer specifically as to what the situation is in this state now.

Mr. Fulton: That is all.

Mr. Richardson: Now Mr. Rogers, have you any other questions?

Mr. Rogers: Say an ordinary man has a cook stove and a heater. When the pressure is down so low that he can just barely get a little blaze, no matter how he works his mixers, why is it that the meter will run faster then that it does when he has a good pressure and when he can have a good hot fire?

[fol. 178] Mr. Wyer: It won't. You just merely think it does.

Mr. Rogers: I would like for you to come to my house and see me when the pressure is low and I will show you.

Mr. Wyer: When you have a pressure down to one quarter ounce, and have a flame an inch long, where do you have your cooking vessels, when you are cooking?

Mr Rogers Our pressure gets so low that some times some of the blaze goes out

Mr Wyer Where do you have your cooking vessels in times of low pressure service?

Mr Rogers With the rest of them I have tried it out to see how to get the best advantage with low pressure and high pressure

Mr Wyer How far is your cooking vessel from the tip of the burners, are you keeping your cooking vessels on top of the stove, on the grid?

Mr Rogers Yes

Mr Wyer Do you smoke?

Mr Rogers Yes I have a cigar, do you want it?

Mr Wyer No, I want a match (lights match) Now this is my cigar (pencil in mouth) How am I going to light it (holding lighted match several inches from end of pencil)?

Mr Rogers You have got to get closer to it

Mr Wyer Exactly so I have to get the match up to the cigar or the cigar to the match, one or the other Now that match is burning, but I am not getting any good out of it Is that the fault of the match? It is burning, and will burn my finger in a minute

Mr Rogers But that was not a cigar in your mouth, it would not light any way

Mr Wyer But you get the point, that to light the cigar you [fol 170] have to get the match to the cigar Now no matter what low pressure gas you have, you have to get the burners up, or the vessels down to the blaze, as was demonstrated down below If you get your vessels down you can cook with three tenths of an inch water pressure, which is fifteen hundredths of an ounce

Mr Rogers When the gas gets so weak that it won't pull air into the mixer?

Mr Wyer Well that is enough

Mr Rogers But your meter will run and run fast?

Mr Wyer Absolutely your statement is untrue it will not run fast, and it will not run unless gas is going through and any statement made by you or anybody else that meters run when the gas is not going through is untrue

Commissioner Russell There is something coming through the line

Mr Wyer I will repeat the statement Mr Commissioner Anyone that makes the statement that the meter runs when the gas is not going through states that which is not true

Mr Rogers There may be gas going through but not enough to make a good fire and yet the meter will run faster than when you have a good fire

Mr Wyer No it will not

Mr Rogers A-k anybody about it I am willing to go to any man's house

Mr Wyer How many feet of gas do you use an hour in cooking an ordinary meal For instance you had beefsteak for dinner, how many feet of gas do you think it would take to cook the meal?

Mr Rogers I have not paid any attention to that I have never noticed

[fol 180] Mr Wyer Well, how many feet do you think it would take to cook an ordinary meal?

Mr Rogers I don't know, I have my gas card for last month, you can see it and see what it is

Mr Wyer I am trying to get you to tell me how many feet of gas would be required to cook this meal

Mr Rogers I have not made that a study in that way. I have went in and asked my wife and she said——

Mr Richardson We object to what his wife said.

Mr Wyer (producing chart) There is the result of cooking a meal at a pressure, which, if the penalty assessment had been enforced, the consumer would have gotten the gas for nothing. The gas cost one dollar per thousand, and that beefsteak dinner was cooked at a cost of 2 4 cents The total meal cost for food was 1 15 cents and that result was obtained with low pressure gas The meal was cooked with low pressure gas and is a complete answer to the statement that it is impossible to cook with low pressure gas because the facts are that less gas will be required at low pressure than at high pressure if you properly use it.

Mr Rogers I am in a part of town that the gas gets so low that we cannot cook with it

Mr Wyer What size service line have you?

Mr Rogers Mine is an inch and a quarter into the meter. It is a flat, 720 North Geary There are twelve families living in the building We have a three room apartment

Mr Wyer What size pipe goes in to supply the twelve families?

Mr Rogers It starts with an inch and a quarter from the meter, [fol 181] but what size comes in from the street to the house I don't know, that is out of sight

Mr Richardson What size service line is there to the basement?

Mr Rogers It is an inch and a quarter at the meter and a half inch at the stove

Mr Richardson You say there are twelve families supplied with an inch and a quarter service line?

Mr Rogers No, each of them. That is at the meter

Mr Richardson You don't know what the size of it is where each one takes his connection?

Mr Rogers I don't know how far this inch and a quarter line runs back

Mr Wyer If you will readjust your cook stove, either raise the burners, or by lowering the vessels, you will be able to cook with pressure so low that the flame will barely come through the burner. On a flame a quarter of an inch long you can broil beefsteak

Mr Rogers This bad weather the pressure has been so low that the hot water heater would barely light

Mr Wyer There is not enough gas to go around during those extreme periods

Mr Rogers There isn't

Mr Wyer No sir, and that will become less each year.

Mr Rogers The less force I have the bigger my gas bill is

Mr Wyer I think you are mistaken on the facts. You have a

different time interval on reading your meter. There is absolutely nothing to the popular idea that meters run faster at low pressure.

Commissioner Russell. One reason they seem to run faster is you can hear them clicking.

[fol. 182] Mr. Wyer. Then the gas is going through and you are getting the benefit of what gas you are getting.

Mr. Russell. No use to tell the people that when their bills are laying right before them and——

Mr. Wyer. Every foot of gas that passes through the meter represents beneficial service which the consumer should pay for.

Commissioner Russell. This testimony is interesting in letting us know what can be done, but for the past this city has been on a basis, and this suit is on the basis of not less than four ounces to eight ounces pressure.

Mr. Wyer. Which is grossly wasteful. It is so high that it blew the water out of the pressure gauge in the basement.

Mr. Rogers. I set meters at Ochelata, repaired them, and put in new discs. When the glass disc would break and those little brass wheels and clock work. I tried to make gas a study on all their kicks on meters. I was working for the city and this weak pressure gas you couldn't get enough to burn, and yet the meter just flew around. All the way I could figure was I never had any back pressure from the stove and meter. That little disc will whirl if there is no back pressure.

Mr. Wyer. Then you had gas?

Mr. Rogers. How is that?

Mr. Wyer. According to your own statement, with the case as you have laid it down, if your statement were true, the meter would actually let pass gas on low pressure conditions and would defraud the company.

Mr. Richardson. Where is your place, Mr. Rogers?

[fol. 183] Mr. Rogers. 720 North Geary, apartment 11.

Mr. Richardson. Do you burn gas at night, all night?

Mr. Rogers. No sir. I never go to sleep at night with any gas burning.

Mr. Richardson. I would like to know what the size of the service pipe is.

Mr. Rogers. I will show it to them at any time.

Mr. Owen. We will call at Mr. Rogers' place and see what the difficulty is.

Mr. Richardson. Have you ever talked with the gas efficiency engineer, or asked the gas efficiency department to investigate it?

A. No sir. I am a little deaf. I worked on a gas well on a fishing job where we had 550 pounds rock pressure, and if we had that well here it would help.

Mr. Wyer. Do you think that one well would help you out?

Mr. Rogers. That well would; it was a deep well. It would supply the city for some time.

Mr. Wyer. One well would supply the city?

Mr. Rogers. Yes sir. 550 pounds was the rock pressure.

Mr. Wyer. What was the open flow of the well?

Mr. Rogers. I forget, but it was large.
Mr. Wyer. How large?
Mr. Rogers. Which?
Mr. Wyer. The open flow capacity of the well?
Mr. Rogers. I forget now what it was, but it was away up there.
Mr. Wyer. How far up? Way up doesn't mean anything.
Mr. Rogers. It was a good many millions. I forget now how much it was.
[fol 184] Mr. Wyer. What per cent of the open flow could you get in your line, assuming it was a million feet, what per cent of the open flow could you get in your line?
Mr. Rogers. I don't believe I understand you.
Mr. Wyer. You say if that well were here it would relieve the difficulty, now for easy arithmetic——
Commissioner Russell. Now there is no use in taking up any more time on that. It doesn't mean anything.
Mr. Richardson. I have a witness here from Wichita, Kansas, whose testimony will be very short and I would like to put him on before we adjourn.
Mr. Rogers. I will give you my place.
Mr. Fulton. You say his testimony will be short, how short?
Mr. Richardson. Five or ten minutes.

(Thereupon the witness Samuel S. Wyer was excused.)

[fol 185] W. A. Wadsworth, being called as a witness on behalf of the respondent, being first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Mr. Wadsworth, how do you spell your name?
A. Wadsworth, W. A. Wadsworth.
Q. You live in Wichita, Kansas?
A. I do.
Q. Are you associated with any gas company there?
A. I am the district manager of the Kansas Gas and Electric Company.
Q. They operate in Wichita, Kansas?
A. They do.
Q. Your company is not connected with the Oklahoma Natural Gas Company in any way, is it?
A. It is not.
Q. Ask you to state to the Commission whether or not the Wichita Natural Gas Company is able to give service in Wichita. I mean whether or not the gas company you are with is able to give service in Wichita, with gas at a two ounce pressure?
A. We are.

Q Do you have any complaints there when you furnish gas at a two ounce pressure?

A Very seldom. If we have complaints at two ounce pressure it is because of difficulty with the equipment or the application of the gas.

Q Can you give service when the equipment is efficient at less than two ounce pressure, and do you have any instances of that in Wichita?

[fol 186] A We do, we give service satisfactorily, which does not cause any complaints, at one ounce. We do not go below that. At this particular time there is a number of cases where burners and equipment have been adjusted efficiently to burn gas satisfactorily under one ounce.

Q If you go below four ounces, is the Gas Company required to make any rebate in its bills?

A No.

Q If you go below three ounces, are you required to make and reduction on its bills, or if you go below two ounces?

A No sir.

Q Have you any means in your office in Wichita, Kansas for illustrating and testing the efficiency of gas at low pressure?

A We have.

Q Did you see the illustration that Miss Elfritz of the Bureau of Mines gave here today?

A I did.

Q Do you have anything analagous to that?

A We do, it is more complete in that we have it shown with other appliances than the range.

Q State to the Commission whether or not you can utilize gas for cooking at lower than one ounce pressure, efficiently?

A We can, and have. It has been demonstrated, or demonstrations have been made similar to the one downstairs although more complete, that a complete meal has been cooked with pressure ranging from one half ounce, to one ounce. The reason for the ranging of pressure from one half ounce to one ounce was that at different states during the process of cooking they might see the effect on the flame and the rapidity with which the cooking was going on.

Q Mr. Wadsworth, you have heard testimony to the effect that [fol 187] the difference between the heating value of gas delivered at one ounce pressure and gas delivered at four ounce pressure was only such heat as about 13 cubic feet in 1 000 would make. Do you know whether that is true?

A From personal tests I do not know that to be true.

Q From authentic reports similar to those that have been submitted?

Commissioner Russell: You have examined what they have in the reports?

A Yes sir.

Q You know that as a matter of general information but without having personally tested it?

A Yes sir.

Q How many consumers do you have in Wichita?

A 15,200

Q That is about the number we have here I presume. What is the number here, Mr. Owen?

Mr. Owen. 16,498 domestic consumers in December.

Q Do you use gas in Wichita for heating purposes too?

A Yes sir, we do.

Q What is your average consumption there?

A About eleven million feet per day. It varies with the temperature.

Q Do they use it in furnaces, or heating stoves?

A Use it very extensively in furnaces. We have not yet gotten the approval of our rate of 30 cents.

Q Wichita is about 100 miles north of Oklahoma City.

A Nearly 200.

Q The climate is colder?

A I believe the weather reports will show the average is lower than it is here.

[fol. 188] Q And you furnish about 11 million feet per day?

A Yes sir.

Q At a pressure from one ounce to two ounces?

A From one to four.

Q But the pressure at two ounces the service is found to be adequate and no complaints?

A Except in remote cases where there is extreme cases of improper application of gas.

Commissioner Russell. You say you are furnishing that at thirty cents per thousand?

A Yes sir.

Commissioner Russell. You haven't your balance sheet with you have you?

A Mr. Commissioner, at the present time there is an interim rate that is inoperative. That interim rate—we don't know whether it will finally be approved or collectible or not. The interim rate is a rate of $2.00 tax on every meter, plus 30 cents a thousand for gas, with an option rate of 50 cents per thousand for gas and 50 cents per month as a maintenance charge. That is for the reason that until the permanent higher rate could be fixed in fairness to the small and large consumer they would have those two rates. We figure it out and it shows that at 100,000 cubic feet used in a year it don't make any different which rate they take, therefore the small and large consumer gets the benefit. The small consumer gets the benefit under the 50-50 rate if he uses less than 100,000 feet per year. That rate was ordered by the Utilities Commission of the State of Kansas to be put in force until such time as the courts decide what the rate should be. It is not collectible until that decision is made.

Mr. Richardson. That is all.

Mr. Fulton. No questions.

(Witness excused.)

Thereupon the Commission adjourned until 10:00 A. M.

[fol 180] Tuesday, January 27th, 1920

Commission duly convened pursuant to adjournment, and the taking of testimony was resumed.

THOMAS E. WEYMOUTH, being called as a witness on behalf of the respondent, Oklahoma Natural Gas Company, being first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. You may give the Commission your full name?

A. Thomas E. Weymouth.

Q. Where do you live?

A. Oil City, Pennsylvania.

Q. In what business are you engaged, Mr. Weymouth?

A. In the natural gas business.

Q. With what natural gas company or companies are you or were you connected?

A. I am the Chief Engineer of the United Natural Gas Company, the Chief Engineer of the Pennsylvania Natural Gas Company, and act in a consulting capacity frequently for the Iroquois Natural Gas Company.

Q. The first company you gave as being Chief Engineer for was what Company?

A. The United Natural Gas Company.

Q. Where is that Company, and what towns and cities does it serve?

A. The company is located in northwest Pennsylvania, and serves Oil City, Meadville, Sharon, Bradford, Du Bois, Franklin, Reynoldsville, Titusville, and a number of smaller towns and villages.

Q. The company has quite a long pipe line, I take it?

A. Yes sir.

[fol 181] Q. What was the name of the other company you are now and with?

A. The Pennsylvania Gas Company.

Q. Where is that company situated, and what towns and cities does it serve?

A. It also is situated in Northwestern Pennsylvania, and serves the cities of Erie, Corry, and Warren, in Pennsylvania, and Jamestown in New York, together with a few other smaller towns and villages.

Q. Then I believe you said you were consulting engineer for the Iroquois Gas Company, in New York?

A. Yes sir.

Q. What towns and cities does the Iroquois Gas Company serve?

A. The Iroquois serves Buffalo, and a great number of smaller towns.

Q. Are there other gas companies which you have, or either of them that you have mentioned, or with which you are associated in any way, connected or related in any way to the Oklahoma Natural

Gas Company, or do they have any interests in common in any property, funds, assets, or anything of that sort?

A. There is absolutely no connection of any kind between them.

Q. Have you had any collegiate or university course or training, that trains you specially for the nature of the work you have done with respect to gas companies?

A. Well, I have graduated with the degree of Bachelor of Science from the Massachusetts Institute of Technology, at Boston, in the year 1897.

Q. Since that time have you been constantly engaged in this matter of engineering for gas companies?

A. For two or six years after my graduation from college I was engaged in the practice of electrical engineering, and since 1903 I [fol. 197] have been engaged exclusively in Oil and Natural Gas engineering.

Q. That has been then for the last seventeen years?

A. Yes sir.

Q. Have you done any general work, written any books or things of that kind in regard to the matters connected with that?

A. Yes. I have written a number of papers for engineering societies in connection with natural gas problems, the American Society of Engineers and the Natural Gas Association of America.

Q. Mr. Weymouth, have you ever made any tests or experiments yourself which would show the relative heat units in a thousand cubic feet of gas at different pressures running from atmospheric pressure to a four ounce pressure?

A. Yes sir, I have.

Q. Assuming that a natural gas company has five patrons in five different portions of a city. Assume that the natural gas company furnishes to each of those patrons, and that each of those patrons has, at a given time, a thousand cubic feet of gas, that the gas is furnished to, and consumed by the first patron at a pressure of four ounces, that it is furnished to and consumed by the second patron at a pressure of three ounces, and that it is furnished to and consumed by the third patron at a pressure of two ounces; that it is furnished to and consumed by the fourth patron at a pressure of one ounce, and to the fifth patron at a pressure of one half an ounce. From the tests which you have made, and the observations you have made of those tests are you able to state to the Commission what the relative heating value of the gas furnished to those different patrons at those [fol. 198] different pressures, each patron getting only one thousand feet of gas, would be?

A. Assuming that the basis is taken as atmospheric pressure?

Q. Yes sir.

A. The first patron receiving his gas under a static pressure of four ounces above atmosphere would receive 1017.5 B. T. U.'s for every cubic foot of gas measured through his meter. The patron receiving his gas under a pressure of three ounces above atmosphere would be receiving 1013 B. T. U. for every foot of gas measured through his meter. The patron receiving his gas at two ounces above atmosphere would be receiving 1008.5 B. T. U. for every cubic foot

of gas measured through his meter. The patron receiving his gas at a pressure of one ounce above atmosphere would be receiving 1004 B. t. u. for every cubic foot of gas measured through his meter, and the patron receiving his gas at one half ounce above atmosphere would be receiving 1002 1-6 B. t. u. for every cubic foot of gas measured through his meter.

Q. I will ask you to state then what the difference in percentage is?

A. Pardon me, may I add to that. I did not give quite sufficient information. I should have said, assuming that the basis is 1000 B. t. u. for each cubic foot of gas at atmospheric pressure.

Q. I will ask you to state then what the difference in percentage is between the number of heat units which the patron who receives his gas at four ounce pressure and that which the patron obtains who receives his gas at a three ounce pressure?

A. The patron who receives his gas at a four ounce pressure receives in round numbers four tenths of one per cent (.4%) greater quantity of gas than the patron receiving his gas at three ounces [fol. 104] pressure.

Q. What is the difference in percentage between the quantity or heating value of the gas which the patron receives who receives his gas at four ounce pressure, and which patron who receives his gas at two ounce pressure?

A. The patron who receives his gas at four ounces pressure is receiving in round numbers, nine-tenths of one per cent (.9%) greater quantity of gas than the patron receiving his gas at a two ounce pressure.

Q. When you say greater quantity, do you mean that he is receiving that much more heating value or heat units?

A. He is receiving that much greater amount of material of which the gas is composed, and the heating value is in direct proportion to the amount of gas supplied.

Q. What is the difference in percentage between the quantity of gas and the number of heat units which a patron receiving his gas at four ounces, and that which the patron receives who receives his gas at a one ounce pressure?

A. The patron receiving his gas at four ounces pressure is receiving one and three tenths per cent (1.3%) greater quantity of gas than the patron receiving his gas under a one ounce pressure.

Q. What is the difference in percentage between the relative quantity of gas, or the relative number of heat units which the patron receives who receives his gas at four ounces pressure, and that which the patron receives who receive his gas at a one half ounce pressure?

A. The patron receiving gas at four ounces pressure is receiving one and five tenths per cent (1.5%) greater quantity than the patron receiving it at a one half ounce pressure.

Q. Have you any apparatus or means of demonstrating the truthfulness [fol. 105] of these statements in regard to the relative quantities of heating units delivered at these different pressures?

A. I have

Q Will you produce it please?

(Witness here produces instruments and apparatus.)

Q I will ask you to explain to the Commission, and I will state here that it would be impossible to get this instrument in the record, and we have no photograph of it, and hence I will ask you to explain what this instrument is?

Commissioner Walker What is the purpose of describing this instrument.

Mr Richardson To show the relative quantity of gas contained in a given volume under the various pressures that have been mentioned.

Commissioner Walker From one, to four ounces?

Mr Richardson Yes sir.

A This long tube this glass tube to the right is merely a vessel for measuring and holding a definite quantity of gas That tube is graduated or subdivided into 100 parts, so that each small division of the scale represents one per cent of the total volume of the total reservoir Connected with this tube at the top and through a stop cock is an auxiliary tube of the same diameter with a scale attached to it and subdivided in the same units as the scale on the main, or large tube so that each small division of the scale on the auxiliary tube represents one per cent of the volume of the large tube Connected with each of these tubes at its bottom by means of a small rubber hose is a leveling tube which is filled with water, thus forming a plunger connection, so to speak, between the leveling tube and [fol 1067] the main tube, and likewise between the auxiliary tube and this leveling tube The stop-cock at the top connecting those two tubes, namely, the main tube and the auxiliary tube is what is known as the three way standard cock, one opening of which connects with the air, or with a gas connection where such is available, the other opening connecting with the main tube, or the second opening connecting with the main tube, and the third opening connecting with the auxiliary tube By placing the core of this stop cock in different positions, it is possible to effect connection between the interior of the main tube and the air or gas supply, while the auxiliary tube is closed to it By placing the stop cock in another position it is possible to effect a connection between the auxiliary tube and the air or gas supply, while the main tube is closed to it By placing the stop cock in another and third position it is possible to effect a connection between the air or gas supply and both tubes simultaneously, and by placing the stop cock in another and fourth position it is possible to close in both tubes The water connection between each tube and this leveling tube acts precisely as the plunger of an automobile tire pump, so that if pressure is brought to bear upon the plunger, which in this case is liquid air or gas may be drawn into the tube, or expelled from the tube when the outlet is open, or may be compressed within the tube if the outlet is closed.

Q Just a moment As I understand you, the pressure you will exert there is the pressure exerted by the weight of the water?

A. I was just going to bring that up next. In the case of the automobile tire pump muscular effort is exerted on the plunger thus creating the pressure which compresses the air within the pump. In this case the muscular effort is expended in raising the leveling [fol. 196] bulb so that the water connecting between the bulb and the tube flows through the bulb into the tube and either expells the air or gas contained therein if the outlet is open, or creates a pressure within the tube if the outlet is closed. In this way it is possible to use this simple device not only to compress the air or gas contained within the tube, but also to act as a *manometer* or pressure gauge for indicating the pressure exerted by the gas within the tube over and above the atmospheric pressure. A scale is attached to the right hand side of the board forming the back-ground of the instrument which is graduated in ounces, and which indicates the pressure exerted on the gas within the tube by making an observation of the difference in level between the air contained in the bulb and that contained in the tube. By turning the stop cock, the three-way cock, so as to effect a connection between both tubes and the atmosphere, by raising and lowering the leveling bulb, air or gas may be drawn in to the main tube.

Commissioner Walker: What have you got that at?

A. Zero. So that the volume of gas contained within the main tube is 100 units as indicated by the scale. At the same time the leveling bulb on the auxiliary tube is raised and lowered with the outlet to the tube connecting with the air or gas supply, such a supply is drawn into this tube to just fill it to the zero mark. You will note that in this position, with the cock open, there is atmospheric pressure of practically 14.4 pounds per square inch exerted on the water in the leveling bulb. In other words, this zero means no pressure above atmosphere. That means no pressure over the atmosphere, or absolute atmospheric pressure of 14.4 pounds. You notice the tube having the same pressure exerted within that tube as [fol. 197] well as in the leveling tube must be the same as is evidenced by the stop cock being open to the air so that this tube is filled with air or gas at atmospheric pressure, which is the zero mark on the guage.

Q. From there, around to here, is gas, is that true (indicating on instrument)?

A. Quite true.

Q. And as you raise this (indicating) that determines how much of the volume of that gas is condensed, is that it?

A. No, what I mean to demonstrate is after I get the tube filled with gas at atmospheric pressure we then have 100 cubic feet or inches of——

Commissioner Walker: In other words it is full of gas?

A. Yes, and no pressure is exerted except the pressure of the atmosphere. Now then by turning the stop cock so as to close both tubes in order that there is no connection with the air or gas supply—

Q. Now wait a minute. When you have turned this stop cock here, the gas from here to there, is separated from here to there (indicating points on instrument)?

A. Yes, the gas from the level of the water in the main tube to the stop cock is entirely separated from any other volumetric space and also the gas from here to here (indicating) is separated and closed in, so we now have this tube full of gas at atmospheric pressure, and as a separate vessel we have the main tube filled with gas, or 100 units of gas at atmospheric pressure. That represents our unit volume, or we may say that is 100 per cent. By raising the leveling bulb on the main tube a pressure is exerted on the gas within the main tube. That pressure is indicated by the scale at the right measuring between the levels of the liquid in the two tubes. You will notice that at four ounces, the pressure is four ounces above [fol. 198] atmosphere. We have atmospheric pressure on the surface of this liquid, together with the weight of the liquid down to this level which is four ounces to the square inch.

Q. This represents pressure, and this shows how much it has condensed?

A. Now you will notice by applying a pressure of four ounces above atmosphere to the gas which was originally atmospheric pressure in the 100 spaces, the pressure has been reduced to $98\frac{1}{2}$.

Q. Do you mean pressure, or volume?

A. The volume has been reduced. Change that to volume. In other words, the volume has been reduced a little over one and one half per cent ($1\frac{1}{2}\%$).

Q. By raising the pressure four ounces?

A. Yes. When you put it back down you create atmospheric pressure again, and again you get the original volume. By bringing it down lower you reduce the pressure so you have less than atmospheric or what is known as partial vacuum, and the gas in the tube expands in that same ratio, in proportion to its absolute pressure. That is, the decreased pressure within the tube. By applying a pressure of four ounces above atmosphere to the same tube you will therefore see that this gas is compressed 1.7 per cent—it is hard to read this exactly, and were we able to lift this tube to a height of thirty-three or four feet we would find that the volume of this gas in here would come up about fifty per cent. In other words, we would then have a pressure of 14.4 pounds above atmosphere, or 28.8 pounds absolute, which would reduce the volume to fifty per cent.

Q. You would have doube the pressure?

A. Yes sir.

Q. And halved the volume?

[fol. 199] A. Yes sir, it is another way of stating Boyle's law. But the application of four ounces pressure means a reduction in volume of 1.7 per cent of the original volume under atmospheric pressure. Now we can go a little further with this if we wish, and see how much air or gas we have to put in to the original quantity in order to bring the volumetric space occupied by it under the higher pressure back to the same volume representing its volume at atmospheric pressure. In other words, we had 100 units of volume at atmospheric pressure. We have applied four ounce pressure above atmosphere and that reduced the volume to 98.3 per cent of its original volume. You

also notice that we now have a certain quantity of gas in the auxiliary tube at atmospheric pressure——

Q. Is this the atmosphere right here?

A. That is atmosphere and it is full and is kept at the same level. Now by raising the auxiliary bulb so as to create a pressure sufficient to force air or gas in to the original space, and by turning the stop cock so as to effect a connection between the two tubes, and with the opening to the gas supply still off, we can force gas in or out of this space, (indicating) but you will notice that requires something over four ounces in order to force the gas in to the main tube which is already under four ounces pressure. We can then raise or lower this tube until we bring the volume occupied by the gas in the main tube back to its original 100 per cent. In other words, back to zero. Now we have 100 volumetric units of gas in the main tube under four ounces of pressure as will be indicated by the pressure gauge scale on the right. Then by closing the stop cock so as to seal up both [fol. 200] tubes again and by bringing down our leveling bulb so as to get the same pressure on the gas in the auxiliary tube and measuring the amount of gas that has been passed in to the main tube we see that we have 1.7 per cent of that gas passed in to the main tube.

Commissioner Walker. The main tube is standing at zero?

A. It has 100 per cent volume, but at four ounce pressure instead of atmospheric, and in order to bring the volume back to its full 100 per cent volumetric space, it was necessary to add a certain amount of gas which we added from this reservoir.

Q. Therefore, you reduced this volume here, (indicating)?

A. We reduced its volume that much, which is the amount of gas that we put in the main tube. The only function of this is to get and measure the quantity of gas to determine how much was necessary to put in the main reservoir in order to bring its volume back to 100 per cent condition after the pressure had been raised to four ounces, which corroborates the statement made in my testimony that it amounts to about 1.7 per cent at four ounces.

Q. Mr. Weymouth, in addition to the tests which you have made and which show that in order to raise a thousand cubic feet of gas in a given container from atmospheric pressure to four ounces above atmosphere it is necessary to add only 1.7 per cent to the gas or 17 cubic feet in 1,000, in addition to having tested that numerous times on your part, and having demonstrated it, is that also the universally stated and accepted law with respect to gas in relation to its volume and its pressure?

A. It is.

Q. And you say that is known as Boyle's Law?

[fol. 201] A. Yes sir.

Q. I understand the atmospheric pressure in this immediate vicinity is 14.4 pounds?

A. That would be about the average throughout the year. It of course varies from day to day.

Q. Now if you have gas at atmospheric pressure, that means the density of the gas is such that it exercises the same pressure in the container that the atmosphere does on the outside?

A. Exactly.

Q. In other words, the gas itself exercises a pressure of 14.4 pounds?

A. Yes sir.

Q. In order to raise it to one ounce above atmosphere, you have merely got to add enough gas to that container so as to make the density such that it exerts a pressure of 14.4 pounds, plus one ounce, is that true?

A. Precisely.

Q. But the relation of the quantity of the gas, with the density is in the same proportion that 14.4 pounds is to 14.4 pounds plus one ounce. Is that right?

A. That is correct.

Q. Now you may state if by doubling the pressure, you mean doubling the absolute pressure?

A. I mean doubling the absolute pressure, or adding to the atmospheric pressure the equivalent of the atmospheric pressure.

Q. In other words in order to halve the volume, if at atmospheric pressure which is 14.4 pounds you have 1,000 cubic feet of gas at atmospheric pressure, in order to halve the volume then you have got to raise that gas to a pressure of 14.4 pounds above atmosphere? [fol. 202] A. Precisely.

Q. You don't mean then that by raising gas that has a pressure of two ounces to a pressure of four ounces, that you have double the pressure?

A. You have only increased the pressure about nine-tenths of one per cent (.9%).

Q. To double the pressure, you mean to double the atmospheric pressure, is that right?

A. Precisely.

Q. Now increasing or decreasing a given quantity of gas neither adds to or takes from the gas any heat units contained in it, does it?

A. It has no effect on the heat units contained in the gas.

Q. Of course, if in order to raise the gas in a certain container whose capacity is fixed to a certain pressure you have got to add more gas to that container, and of course in adding more gas you would add more heat units?

A. Precisely, and the heat units added would be in direct proportion to the additional quantity of gas.

Q. Added to bring it up to the requisite pressure?

A. Yes sir.

Q. Now if you assume that you have 1,000 cubic feet of gas at four ounce pressure, what would be the relative quantity of gas in the same container but having only a three ounce pressure, just give me the quantity in cubic feet?

A. You would have 900 cubic feet under the three ounce condition.

Q. If you filled the same container holding a 1,000 cubic feet of gas, with gas but only at a two ounce pressure, how many cubic

feet relatively would you have as compared with the same container filled with gas at four ounces pressure?

A. In round number, 991 cubic feet under the two ounce condition.

[fol. 203] Q. And how much at one ounce?

A. 987 cubic feet.

Q. How much would you have at one-half ounce?

A. 985.

Q. Does that also represent the relative heating value of gas at those different pressures?

A. Pardon me, may I correct that last one,—no, that is correct. Now what was your last question?

Q. Does that also represent the relative heating value of the gas at those different pressures?

A. It does.

Q. And if each consumer, the one who got the 1,000 measured cubic feet of gas at 4 ounces, and the one at 3 ounces, and the one at 2 ounces, and the one at 1 ounce, and the one at ½ ounce pressure, each paid the same price for his 1,000 cubic feet of gas thus measured to him at those different pressures, would the difference in the heating value of the gas, or the number of B. t. u. contained in it, and the quantity of gas that he got, be a significant factor? Would it mount to anything in the payment of his bill?

A. It would be absolutely insignificant.

Q. A great many people assume and think that their meter runs faster at a low pressure than it does at a higher pressure, do you know whether that is true or not?

A. It is absolutely fallacious.

Q. The effect of low pressure then is not to say that a person who gets a certain quantity of gas measured to him through the meter—I mean who uses a certain quantity of gas measured to him through the meter did not get practically all that was measured, but as I understand you, the real effect of low pressure is that it does not measure it to him as fast as he wants it, is that it?

[fol. 204] A. That is true. When the pressure is low it means he cannot get as much gas as he wants but what the meter registers is the correct amount of gas that he has obtained and used.

Q. Now I have here a table that you made showing the amount of gas that would be delivered, the relative amount of gas that would be delivered at varying pressures, and which would be registered on the meter. Now assuming that a meter is so adjusted that it delivers and registers 180 cubic feet an hour at a four ounce pressure, what would the same meter deliver; that is, how much would it deliver at a 3 ounce pressure?

A. If the delivery of gas to the appliances were represented by 180 when the pressure within the line is 4 ounces, the gas that would pass into the appliances when the pressure dropped to 3 ounces would be represented by 87 feet.

Q. And how much would it deliver at a 2 ounce pressure?

A. 71 cubic feet.

Q. And at 1 ounce pressure, how much would it deliver?

A. 50 cubic feet.

Q. How much would it be at one-half an ounce?

A. 35 feet.

Q. But when this gas was delivered to the person at a 3 ounce pressure you say the gas would only pass through at the rate of 86 feet per hour, assuming that it would pass through at the rate of 100 feet an hour with 4 ounce pressure?

A. Precisely.

Q. Is that 86 feet per hour all the meter would register?

A. No, I think the meter has really nothing to do with that.

Q. The meter would register the amount that goes through and as I understand, that is all that goes through at a 3 ounce pressure? [fol. 205] A. That is true.

Q. Would the meter register correctly?

A. Precisely.

Q. So a man would not be charged with 100 feet an hour, but would only be charged with 86 cubic feet?

A. He would be charged with 86 feet only.

Q. And if at two ounce pressure only 71 cubic feet goes through, is that 71 feet all that the meter would register and all that he would be charged with?

A. That is all the meter would register under that pressure.

Q. That is what I say, the conditions are the same excepting the pressure is changed to 2 ounces?

A. Yes.

Q. And if the pressure is changed to 1 ounce, you say that 50 cubic feet is all that would pass through in an hour and that 50 feet would be all that his meter would register?

A. Precisely.

Q. Would he in fact have and get this 86 feet at 3 ounce pressure, 71 feet at 2 ounce pressure, and 50 feet at one ounce pressure?

A. Yes sir.

Q. So that if he had any complaint to make it would not be that he was not getting in gas and heating units what he was charged with, but that he was not getting the quantity he wanted or needed?

A. That is perfectly true.

Q. Do you know whether or not the inadequacy of the gas supplied during the months of November and December, 1919, in so far as furnishing to the patrons of gas companies all the gas they wanted or needed was confined to the Oklahoma Natural Gas Com- [fol. 206] pany, or do you know whether or not it was Nation-wide.

A. That condition was Nation-wide.

Q. Do you know that it existed in all the gas companies in Pennsylvania and New York?

A. I know from personal experience that it existed with the gas companies in Pennsylvania and New York, and from reports of the press in other fields, that it was nation-wide.

Q. And do you know that it was so acute and so nation-wide that the Secretary of the Interior called a conference to be held at Washington on January 15th, 1920, in which he stated that the shortage of gas was nation-wide and that he was calling a conference

of the Governors of the gas states, and the Public Utilities Commissions and the Gas Companies in the Gas States, for the purpose of devising a plan for the conservation of the Nation's rapidly failing gas supply?

A. I do know that to be true.

Q. And that conference was held?

A. It was.

Q. Something has been said about the matter of a gas company putting air in to its pipe line. I will ask you to state whether or not you ever knew or heard of that being done?

A. I have not, and I do know that every effort is made by all gas companies to avoid any such possibility.

Q. If air in a sufficient quantity to be detected by a chemical analysis of the gas, or to affect the heating value of the gas should be allowed in to the pipe line, what would be the result with respect to the danger of explosions and matters of that kind in the pipe line?

A. There would be extreme danger that the whole system or important parts of it would be blown up.

[fol. 206½] Q. As I understand, gas without any mixture of air in it is not inflam-able?

A. No.

Q. But when mixed with air it becomes a very high and dangerous explosive?

A. It does.

Q. Do you know whether or not there are any cases on record where air got into a pipe line and it was blown up?

A. Well during the construction of a line, when the lines are first filled with gas, the danger exists that something will ignite the mixture that is formed as the gas is displacing the air, and in that case it might blow up, and in one case where we were preparing to test a new field line that had been laid, it became ignited and blew the line up.

Q. Did it just blow it up at one place, or was it extensive?

A. Practically throughout the whole length of the line.

Q. Would there be danger where lines are laid under street railway lines of it being ignited from electric action, such as electrolysis or anything of that sort or from sparks generated by friction?

A. The eletrolysis would have the effect of producing openings in the pipe, that is corroding the pipe so that the gas could leak from it and as that gas comes to the surface it may be ignited.

Q. If a gas company has a fixed investment and fixed overhead charges and the amount of gas available to it becomes diminished so that it cannot furnish and sell the quantity of gas which it could furnish and sell formerly, would that diminution in the supply look towards a reduced or a higher price for the gas?

A. It would look towards a higher price.

[fol. 207] Q. Are there any other matters that I have omitted to ask you about that occure to you Mr. Weymouth?

A. I think not.

Commissioner Walker: One question I want to ask there. The question of the speed of the meter as the pressure of the gas goes down. One of the main complaints they make is that the meters, as the gas pressure becomes low, they keep up the same rate of speed showing as much or more gas being used even though they don't get it. How do you account for that?

A. I account for that in several ways. In the first place, the consumer remembers only the short period of time throughout the month during which his pressure was low. He very seldom reads his meter during low pressure periods to ascertain the rate at which the gas is passing through it, and at the end of the month he finds that he has a high bill, although during that month he may have encountered periods when he was not getting a sufficient amount of gas for his needs. Preceding the shortage, however, and immediately following, and during the greater portion of the month, he has been getting an adequate supply of gas at high pressure which supplied all his needs at very cold weather, and when he was using a very great quantity of gas, much greater perhaps than the preceding month. That quantity of gas, together with the quantity of gas used during the period of shortage forms an aggregate which is higher than the month he compares his bill with when he did not use so much gas, and the result of the psysodogical effect of it is that he thinks because he has had periods of shortage which were relatively of short duration he should have a lower bill, whereas, as a matter of fact, he has actually, during the whole month, used a much greater quantity of gas. Besides that, during these periods which is when the weather is so very cold that the demand is excessive, there are high winds [fol. 208] which carry the hot air away from the buildings much more rapidly than a still cold temperature, and his drainage upon the gas supply is excessive.

Mr. Richardson: Might there be another explanation also? When the weather is not so cold, when it is moderate, he has no need for, and is not using so much gas. So that his appliances are partially closed or shut off?

A. That is quite true.

Q. And when the extreme cold weather comes the pressure goes down, but he needs a higher supply, he needs more gas than he needed in warmer weather, and he opens his burners wide open and the gas is passing through?

A. That is true, and then there is the further fact that we call in engineering parlance, his load factor is very high during cold weather. What I mean by that is that during cold weather when the gas company encounters these periods of shortage, the demands by the consumers create a severe drain upon the system. That is, they are burning gas constantly 24 hours a day at a very high rate of consumption which means that the total quantity of gas passing through their meters is very high, whereas in months that they use for comparison there may be certain days where they would use gas at practically the same rate as during the steady cold month, but these days are few and far between and in the periods when the

weather is more moderate they shut their appliances off and do not use nearly the quantity of gas that they used during the peak load period so that the sum total of gas consumed during the steady cold month may be very much greater than during the month with ups and downs in temperature where the minimum temperature may be even lower than it is during the steady month, for certain days.

[fol. 209] Commissioner Russell: Could it also be possible those heat units pass through and fail to be utilized, that the appliances cannot capture them and apply them to use?

A That condition would apply to both the low pressure and the heavy pressure. That would of course mean that he would not be able to get as much gas as he needed when the demand was excessive, whereas he might get all he needed if his appliances were sufficiently economic and efficient to utilize the gas properly that did come through.

Commissioner Russell: If a consumer whose appliances are adjusted to eight ounces, which he is accustomed to, when he gets one or two ounces gas, will he get relatively the value out of that gas in heating his apartment that is represented by the number of feet of gas he gets, or the number of heat units that passes his way?

A It is a little difficult to answer and give a positive answer to that question for the reason that when the pressure is eight ounces the temperature is mild and the appliances that he uses are automatically regulated by him, which has the effect of producing a low pressure, for at the pressure given he shuts off the gas. He never brings the full eight ounces to his appliances, in mild weather.

Commissioner Walker: Because it would flare out in front?

A Yes, or would give him too much heat.

Commissioner Walker: He would turn it down low then?

A Yes, in mild weather might turn the values off altogether but still have the eight ounces on the appliances, so it is impossible to give a positive answer to a question like that because of the variable conditions under the mild weather condition.

[fol. 210] Mr Richardson: There is one other question I want to ask you. Is there any other public service in which the efficiency of the service depends so much upon the patrons as is the case in the furnishing and use of natural gas?

A No, there is not.

Q The patrons runs the pipe from the curb to his house does he not?

A Yes, it is under his control.

Q And he also pipes his own house?

A Yes sir.

Q And he determines the size of those pipes?

A Yes sir.

Q He also purchases his own appliances in which he burns the gas?

A He does.

Q And he determines for himself the nature and character of those appliances?

A Yes.

Q And on that may also depend the extent of the gas of the amount of the pressure that he uses in those appliances?

A Yes sir.

Q And the matter of the mixer, the mixing of the air with the gas and the regulation of those things?

A Yes sir.

Q And the question of whether they are clean or not, and kept clean?

A Yes sir.

Q Each of those factors which I have mentioned enter into the efficient use of gas?

A They are very vital.

Q And all of those depend, not on the gas company, but on [fol 211] the patrons do they not?

A Absolutely.

Q Is there any other Public Service that you know of that is rendered where matters of that kind depend on the patron?

A No other public service approaches it in that respect.

Q So that absolutely all the gas company can do is to deliver the gas into the patron's line at the curb and the use he makes of it thereafter depends upon the patron and his own appliances and the efficiency at which he keeps them?

A Precisely.

Mr Richardson That is all.

Cross-examination

By Mr F L Fulton

Q In other words, the way the patron uses the gas has nothing to do with the supply That is controlled by the Company is it not?

A No, the supply is fixed by nature.

Q I mean the supply that comes in to his house?

A The Company has nothing to do with the supply, that is governed entirely by nature itself.

Q The supply the gas Company can furnish is dependent on nature?

A Yes sir.

Q It has nothing to do with the number of wells they may connect with?

A Not of course the number of lines, or consumers.

Q Then to come down to that, the consumer has nothing to do with the supply of gas, that depends on the company?

A It depends on the way the Company operates its property, certainly.

[fol 212] Q Now how much air does there have to be in gas before it can be detected by the instruments we have?

A If there is one per cent of air in gas it can be detected by analysis.

Q How much air does there have to be in gas before you say it becomes dangerous?

A About four or five volumes of air to one of gas would be excessive, I think.

Q Four of air to one of gas?

A Yes sir.

Q If three of air to one of gas it would not be particularly dangerous?

A It would be dangerous because if you are—now I had this in mind in answering the question, not what you are evidently referring to now,—because if there was a possibility of getting even one per cent or two per cent of air in your gas there would be the possibility that—or there might be the possibility that you would get a sufficient quantity to become excessive.

Q I don't quite understand you. I thought you said a moment ago that three of air to one of gas would be dangerous?

Commissioner Russell: Four or five he said.

A Four or five of air to one of gas, as I recollect it.

Q And now you say that if there was as much as one of air it would be dangerous. I don't understand you.

A Because of the possibility. You have no control of that. If you get that much——

Mr. Richardson: If you get that much you are liable to get more?

A Precisely.

Q But so long as you have only one or two parts of air to one of [fol. 213] gas it is not dangerous?

A Unless you would get more.

Q It would not be dangerous if limited to that amount?

A One cubic foot of air to one of gas would not be dangerous.

Q One cubic foot of air to one of gas would not be dangerous unless you get more in there, is that the point?

A No, I don't believe you could explode that.

Q That air would measure the same as gas in going through the meter?

A Precisely.

Q Do you know—take this case, where, assuming that the apparatus is reasonably well in shape, say in a cooking range where it will burn a nice bright blue flame, did you ever have it called to your attention where it was suddenly changed to a red flame, and would burn with a red flame for two or three or four hours, and then would go back to a bright blue flame?

A I have never seen that happen.

Q Well I have. It has happened time and again at my place. The flame would be as red as could be, and there would be no heat in it and it would burn that way for hours.

A How did you test it to determine the heat in it?

Q By cooking and noticing the length of time it took to boil water.

A How many minutes did it take you to make the water boil?

Q. I did not make any scientific test. My wife would say "I can't get supper tonight, there is no heat"——

A. You never made any real comparison then?

Q. No. I just wondered what brought it about. That has happened time and again. Suppose we had half air and half gas, how would that show in the cooking and heating?

[fol. 214] A. You would not notice it if they were thoroughly mixed.

Q. Then it is possible for them to have that amount of air in the gas line and get paid for that air and the consumer not know the difference except in the heat?

A. If you mean is it a physical possibility I would say that it is.

Q. If that was the case it would affect the heating qualities of the gas would it not?

A. The heating qualities would be in direct proportion to the quantity of gas in a cubic foot measured.

Q. Do you know of any other thing that would cause these conditions I mentioned? All I know is what my wife says. Our range is the ordinary one—what is the name of it—it has a picture of a chicken hatching out—Quick Meal, that is the name of it. It is supposed to be a good range, does pretty good service. Has open top and is pretty close to the flame, and here just the other night there wasn't any gas shortage at all, but she said "this thing simply won't cook." There was a good flame but the stuff simply wouldn't cook. That is in time compared where she would ordinarily be through say in thirty minutes it would take forty five minutes.

Mr. Richardson. I can answer that question.

A. All right.

Mr. Richardson. Too rich.

Q. Well the needle in my meter was running all the time and I had to pay the bills. That is not a singular instance with me but I venture the assertion there is not a person in town but what has had that experience.

A. You mean the flame was burning in apparently normal fashion?

Q. Yes?

A. No apparent difference between it then and at other times?

[fol. 215] Q. No. This is not the red flame now——

A. It was not excessively blue?

Q. No. I could not see any difference in it but there was such a great difference in the heating value of it.

A. Was it perceptible?

Q. Yes, and I remember the other night she called me out, she was frying steak and she had had it on the grid or whatever you call it, for quite a while and the grease in there was not sputtering, and she had it turned on and there was a true blue flame.

A. The pressure was high as normal?

Q. The pressure was all right.

A. I cannot conceive what the situation is.

Q. That was what made me think there was air. I don't know.

A. You realize of course that before you burn your gas you have to mix air with it?

Q. Yes, I understand that.

A. But if the air were thoroughly mixed with the gas when it came through you would have perhaps an excess of air, but it would be perfectly obvious if there were too much air. I cannot conceive of such a condition as you describe. I never ran across it in my experience.

Mr. Richardson: Do you recall whether the door was open or whether there was a draft in the house?

Q. No, it was too cold for that. It has been within the last week. That has been the condition for several weeks. While on that subject I will relate an experience that I assume every user of gas has had. I would notice my gas bills for one month would be almost identical with the bill for that month in a previous year. Did not vary as much as one dollar. That was when I was paying the bills [fol. 216] myself. One month in January certain things happened that caused me to remember it very plainly. We had the gas on in the furnace night and day for two weeks. Ordinarily we never burn the gas at night excepting in real severe weather to keep the pipes from freezing, but this time we had the gas on for two weeks, night and day, and kept the house warm on account of sickness in the family. My bill for January was practically the same as it was the previous January. In February, immediately following, we did not have the gas on a single night, either in the stoves or furnace, and my bill for February was fully one third larger, if I remember now, than it was for January. I took it up with the Company and they said it was colder weather and I didn't believe it. I got an absolute statement from the weather bureau as to the temperature and the wind velocity for the two months, and it was much colder in January and we had more wind than in February. Can you explain that condition?

A. I think the probable explanation of that is the fact that during January of that year in all probability they read your meter earlier than was usually the custom which would have the effect of throwing part of the high January consumption over into the February meter reading. It may be that the February reading was later than usual so that perhaps you would have 35 or 40 days consumption shown in your bill for February and only about 20 days for January.

Q. It doesn't happen to be that way because they read it within a day or two of the time. Then I had this other experience. I remember one month in February. I have forgotten the exact year. I made a business trip to California, took my family with me, and the house was shut up for ten days in February, and my bill that year was just as large as ever.

[fol. 217] A. I have a friend in California who went away and was gone a year and a half, and when he came back their gas bill was forty dollars. Their house leakage was forty dollars.

Q. It has to leak through the meter?

A. It leaks from your house system.

Q. How could that be possible if it is not a meter leaking?

A. The meter merely registers the amount that passes through the meter.

Q. Has to pass through the pipes don't it?

A. In its way through the pipes to the equipment through the house. They are responsible for the leaks.

Q. And it might leak gas outside?

A. Surely, but the meter does not leak. If the meter leaks it does not register anything.

Q. Would it be possible where the gas bill was running along fifteen to eighteen dollars a month to have as much as one third of it leaking without noticing it?

A. It is quite possible, yes. You said there was nobody in the house so it would not be noticeable.

Q. I just call attention to those things. It has happened to me not only once, but dozens and dozens and dozens of times. That is the reason the people have the feeling that they are not getting what they pay for. I know that time and again I will be away and the house shut up for several days and there is no difference in the bill over the previous year. Other times I will have company and I will burn I know, more gas, and yet there is no perceptible difference.

A. It will be very enlightening to you and all consumers if you would make a practice of going down every morning and reading the meter.

[fol. 318] Q. They read it all right. I have followed that out for months and months.

A. Merely to give you an idea of the varying consumption under different conditions of weather and so forth. I think the misconception is due to the fact that people don't study the actual conditions and they get impressions which are not accurate.

Q. But that one time I mentioned I had the records. Now let me understand this. You gave a table here for each cubic foot of gas passed through at atmospheric pressure with 1,000 B. t. u. up to four ounces where it would be 1,017½ B. T. U. per cubic foot. Have you the figures there for eight ounces?

A. You mean what would be the relationship between the atmosphere and eight ounces?

Q. What would be the amount of B. T. U.'s with the pressure at eight ounces?

A. It would be 1,035 B. T. U.'s at eight ounces as compared with 1,000 at atmospheric.

Q. How much would it be at seven ounces?

A. Practically 1,030.

Q. And at 6 ounces?

A. 1,026.

Q. And at 5 ounces?

A. 1,022.

Q. Now the meter registers a cubic foot of gas regardless of the number of heat units in it. That would have no effect on the meter would it?

A. No. That is, it does register 1,000 cubic feet regardless of the number of heat units.

Q. For instance 1,000 cubic feet of gas at atmospheric pressure would be exactly the same as 1,000 cubic feet of gas at eight ounces? [fol. 219] A. Your meter would register 1,000 cubic feet if that volume went through, irrespective of the number of B. T. U's contained in it.

Q. At atmospheric pressure, you say there is 1,000 heat units in a cubic foot, and in a thousand cubic feet there would be a thousand times that?

A. Yes.

Q. In other words, a million B. T. U's in 1,000 cubic feet of gas.

A. Yes.

Q. Now you are more familiar with figures than I am, what would you say as to 2,000 cubic feet a year being the average volume of gas for the average family user. Is it or not?—Oh no, 200,000 I meant.

A. It is excessive in this climate. It is usual in northwestern Canada, but not here.

Q. What would be the average here for cooking, heating, and for average family use?

A. Perhaps 145 to 150 thousand cubic feet.

Q. Take 150,000 in round numbers. Figure out what difference there would be in heat units received by a user who received his gas at atmospheric pressure, and the one who received his gas at eight ounce pressure.

Commissioner Russell. It would be 3.4 per cent.

Q. I want to get it in figures.

A. You mean for one year I presume?

Q. Yes.

A. And your range was from atmospheric to eight ounces, was it?

Q. Yes, I want it at atmospheric, and also at eight ounces.

A. It would amount to 52½ million B. T. U's, worth $2.10.

Q. Just be a difference of $2.10 on the bill?

[fol. 220] Commissioner Russell: Didn't you make a mistake?

A. Yes, it is 5,250,000, worth 21 cents.

Commissioner Russell. It is worth more than 21 cents at any kind of prices we have here. That is 5,250 feet of gas which would be $2.10 in place of 21 cents. You made a mistake again.

A. Correct, it would be worth $2.10.

Q. One point the Commissioner brought out that I did not get quite clear, and that was this. Whether or not there could be adequate service where the gas pressure was supposed to be maintained at six or eight ounces pressure, and should suddenly drop to say one ounce or less. Where all the apparatus and everything was arranged for that kind of pressure, could the consumer get reasonable or adequate service where that sort of a drop in pressure is made? I understand when the pressure runs along at two ounces

you can adjust your apparatus so you can get reasonably adequate service, is that correct?

A. Well, you can down to one ounce.

Q. That is for cooking, but you can't for heating, can you?

A. Yes you can get good heating effects with one ounce pressure.

Q. How, in furnaces?

A. Yes, I do in steam boilers.

Q. How about hot air furnaces?

A. If it is properly designed and properly adjusted.

Q. How does it have to be adjusted?

A. So as to give proper combustion with one ounce pressure of gas.

Q. But here was the point I was trying to get at. Say at my place. I get very good service say. Where the gas pressure is from six to eight ounces, and when it drops down to one ounce, is there any way that a person without any knowledge of gas engineering, say [fol. 221] just an ordinary housewife could adjust those stoves and ranges so as to get reasonably adequate service?

A. It is not expected that she could do that without proper instructions.

Q. What would be necessary to be the extent of those instructions? Have to take a course of study?

A. No, she could be told in a very few words by such a department, as I understand they are maintaining for instructions.

Q. Is it not true that there are stoves that are designed for eight or from six to eight ounce pressure, and that it is more economical to use those stoves at that pressure than at any other kind of pressure?

A. I don't know for a fact that the stoves were properly designed for such a pressure as that, although there are some stoves that cannot be used under low pressures in their present condition. There is no question about that.

Q. Assuming that stoves are designed for that kind of pressure then it would not be possible to regulate them would it, so as to give satisfactory service from low pressure?

A. There are stoves that cannot be regulated to get the best effect from low pressure, although great improvement can be made in them.

Mr. Fulton. That is all.

Commissioner Russell. Mr. Rogers, do you want to ask any questions?

Questions by Mr. Rogers:

Q. I have worked on a good many of these gas wells and I would like to ask you a question. Is it not possible the gas will get weak enough that when it goes through the air mixer that it won't pull in enough air to mix it right?

A. That is possible, yes.

[fol. 222] Q. Now your meters will register more at that time wide open than it will where you have it pinched, and get plenty of air and a good fire?

A Under that condition you are not getting the most efficient result, and of course you are burning more gas than would be necessary were the apparatus so equipped and designed and adjusted as to give you the proper mixture under low pressure.

Q This is the trouble in the part of town I live in. The gas pressure gets so low that it must be a way less then a half ounce a lot of the time. I cannot regulate my mixer so I can sometimes barely light it. Now then I can open up the three places and then just a little flame along there in front in the asbestos, but my gas meter is clicking a whole lot faster. I have not timed it by my watch to see how much faster, but it goes a good deal faster than it does when I have a good hot blaze in each of those three places.

A Of course any such statement as that would have to be backed up by corroborative testimony because I realize that the general impression is the meter runs faster when the pressure is low, and you are not getting the gas, but that is also a mistake, I think, in every case. It is true your meter may be running and you may not be getting the heat because you are not utilizing the gas properly where it is coming out. You will get more heat when your meter is running faster than under the same conditions when it is running slower.

Q As I understand it, we have to have about ten parts of air to one of gas to get a good hot fire?

A That is correct.

Q Now if we haven't enough pressure to pull the air through and mix it before it gets to the flame why we can't get a hot fire. It [fol 223] gets that low?

A I don't know whether it does or not, but if it does get that low it goes to the same principle as if it got so low that it won't burn at all.

Q That is true here in some portions of the time my fire has gone out with the valves wide open. No gas at all.

A It is quite possible that the conditions may be such at your appliances to cause that, and yet in the mains be sufficiently high to supply the consumer.

Q You are a stranger. I will tell you the trouble. The gas mains was at one time all right, but this city has built faster than any city in the United States I guess, from the way it has grown up since I have been here, and now they keep on building houses between, and keep building on, and building on, until finally coming through the regulator house it gets to where we have no gas. They did all build for gas we know.

A I don't know anything about the details of their distributing system, so I could not answer that phase of it.

Q They have a regulator plant a mile back here, and they run all the lines they can, keep on building and building, and pulling the gas off until they finally have it all gone before it gets down here.

A That would depend on the size of the plant, so I could not answer that.

Q I run a regulator station——

Mr. Richardson: If this gentleman is going to testify I would like to have him sworn and testify at the proper time.

Commissioner Russell: You can ask the other man questions, but not testify at this time yourself.

Mr. Rogers: I was just going to tell my experience.

[fol. 224] Commissioner Walker: You can tell that when you go on the stand. Your experience you will have to tell then.

Mr. Rogers: When the gas pressure gets so low it cannot mix the gas properly with air before it is lit.

A. That is the condition they complain of when they say they have no gas.

Mr. Richardson: We are prepared to show they have a forty-room house with an inch and a quarter line, and thirteen meters on it, and that the soot and scales are hanging so thick that the gas cannot get through. We have examined his place since he testified yesterday. Now he can ask whatever questions he wants to.

Mr. Rogers: Is it possible for gas to get weak enough so that it won't pull air in through the mixer before it is lit?

A. It is possible for gas to get weak enough that it cannot do that. I don't know that it does in this plant.

Mr. Rogers: Well that's the trouble in the part of town I live in.

Commissioner Walker: We will stand adjourned until one o'clock this afternoon.

(Thereupon the hearing adjourned until 1:00 p. m.)

Duly convened at 1:00 p. m., the Commissioners and parties present as at the time of adjournment.

Mr. THOMAS R. WEYMOUTH re-called for further direct examination.

Questions by Mr. Richardson:

Q. Mr. Weymouth, you were being asked with regard to air in the pipe lines. Do you know whether or not air would mix very readily with gas in the pipe line?

[fol. 225] A. As a usual thing, if air gets into a pipe line it stratifies, and does not result in any uniform mixture.

Q. The result would be that instead of mixing with the gas it would be in spots?

A. In little spots, and spuds, so to speak, so if it got in only at certain spots it might render it dangerous at those places. That was what I meant when I spoke of the percentage being dangerous that would not otherwise be explosive.

Q. Mr. Fulton was asking you in regard to a yellow flame when he was burning gas in his cook stove. Is a yellow flame indicative of too much air?

A. It is indicative of too little air.

Q. The fact that he had a yellow flame would not indicate that air was mixed with the gas?

A. Not at all, but just to the contrary.

Q. In regard to the fact that the gas might burn for a while with a greenish blue flame that indicates proper combustion and then turns to a yellow flame, and then subsequently burns with a greenish blue flame again, is there anything about that indicating rust or soot or dirt in the burner? Would that have anything to do with it?

A. The presence of impurities in the gas in the way of solid impurities principally, will have that effect and produce a colored flame.

Q. Did you notice the demonstration given by Miss Elifritz yesterday?

A. I did.

Q. Did you notice that after she had shaken up the rust or dirt in the burner how it burned with a yellow flame for a while?

A. Yes sir.

[fol. 226] Q. Will that cause it for a while?

A. It almost invariably performs in that fashion.

Q. In regard to the character of service at the place of Mr. Rogers when he was asking you about it, I will ask you this question. If Mr. Rogers lives in a flat of about forty rooms, in which there are 13 different meters, and 13 different services, and that whole thirteen different meters and service is supplied through a pipe that comes into the house only an inch and a quarter in size, would you suppose there would be plenty of gas?

A. I would consider it phenomenal if they got any decent service at any time.

Q. What size pipe coming into a house of about forty rooms, supplying thirteen different meters would be necessary in order to carry an adequate quantity of gas in there to be distributed among those thirteen meters?

A. A pipe not less than three inches in diameter should be used for that service.

Q. How large a house, or how many rooms for ordinary cooking and heating would an inch and a quarter pipe supply?

A. An inch and a quarter pipe will supply a six-room house provided the house is reasonably well constructed.

Mr. Richardson: That is all.

Questions by Mr. Fulton:

Q. Just one question. Your suggestion that the red flame I called your attention to might have been caused by rust or dust in the burner, is that correct?

A. Yes, that is one possible explanation of it.

Q. That would be only temporary, just for a minute or two until the dust or rust burned out?

[fol. 227] A. Yes, and that was the way I understood this to be.

Q. No, it burned that way all the time she was getting the meal, possibly half an hour.

A. There is another explanation of that, and that is there may have been some temporary obstruction coming in front of the air opening in your burner which would have the same effect.

Mr. Fulton: That is all.
Mr. Rogers: I would like to ask a question.
Commissioner Russell: All right.

Questions by Mr. Rogers:

Q. As I understand this inch and a quarter pipe, as I told you before dinner, if you had a real low pressure, and talking about your fire, the meter might possible run faster if you had a poor fire than if you had a good fire?

A. I don't believe I understand your question.

Q. Can the gas going through the air mixer, if you have so little pressure that it cannot mix the air properly with the gas and you have a very little blaze, with the valve wide open, what I want to find out is why the meter will run faster than it does if you have a good pressure and a good fire?

A. It won't run faster.

Q. Well, I have timed it with my watch.

A. You will find out if you are having a small blaze, with low pressure, that your meter will be running slower than if you have a high pressure and a full blaze, and it will be considerably slower.

Q. This inch and a quarter pipe business, you see I did not know what size line there was until we looked at it last night after I talked here yesterday. As it comes there I have lived in the flat four or five [fol 228] years. There is 12 apartments, each apartment has his own meter and there is a meter that belongs to the flat that feeds the automatic hot water heater, and each apartment I think has got two stoves. That is 24 stoves in that building, and we get gas through this inch and a quarter pipe. Now then we will get awful poor service when the gas is low, won't we?

A. You certainly should get very poor service with such connection.

Q. Well it has went out. Now I want to find out why, when we have a cold month, why our gas bills are higher in the flat and we have no gas than they are when we have it just reasonably cold and we have all the fire we want.

A. I am sure I don't know just what your conditions are, but I should say off-hand, that when you have all the fire you want that you don't want very much.

Q. When we have an ordinarily good fire and can keep warm by, but when it is cold there why everybody nearly freezes.

A. But you have the fire burning all the time do you not?

Q. I don't think anybody burns them at night. I think everybody is afraid to.

A. When you do burn them there is a steady strain. You don't burn them for an hour, and then off, but you have them burning all day long?

A. In the apartment I am in the fire very often don't burn at all because my wife and me both work, and some of the other people there do not burn their in the day time because they work too. They are working people that lives there, pretty near all that lives in the flat. That is the point I wanted to get at is why the gas bill is higher when I have small fire than it is when we have plenty of gas?

A. It is because you have burned more gas, then when you have [fol. 229] when you had plenty of pressure.

Q. There is no way I can regulate the air, the pressure is too low to get a fire with it. It gets so weak.

A. I am not surprised that the pressure is weak at your place with low pressure, with the piping system you have and the size of your connections. You realize, of course, that it is possible to shut off the gas entirely so you would not get any in there. Not get any flame.

Q. How is that?

A. It is possible not to have any gas burning.

A. It is a fact then that the gas pressure will get so low that it won't mix the air properly with the gas to burn?

A. Yes sir, if there is a restricted connection from the main to your appliances and then have a great many appliances and burners on them turned wide open, the pressure at the mouth of those appliances will unquestionably be so low that it would be possible for it to be impossible to procure combustion, and you would have a flashing back in the mixer, but that is not the fault of the gas supply. That is the fault of the equipment you have.

Q. We are just about like everybody else is.

Mr. Richardson. Do you want the gas company to go down there and re-pipe your house for you.

Mr. Rogers. No sir.

Commissioner Russell. I would like to ask a question with regard to the failure of the air and gas to coalesce or mix properly, or come along in slugs. The danger in that, as I catch it, is when a slug of air comes along the fire goes out, and then the gas will follow up?

A. That is not the idea I had in mind. The danger—well, to [fol. 230] go back—in order to effect a mixture, you have to have present what is known technically as the process of diffusion. That is, the process of passing the minute particles called molecules of gas into and among the particles or molecules of air, and vice versa, intermingling all those particles with each other. In a pipe line, should a considerable quantity of air get into it, the surface over which the diffusion process can take place is relatively very small, being a cross-section area of the pipe, which means that the process of diffusion is very slight, so that at the high velocity with which the gas passes from the field toward the distributing center, the diffusion that has taken place is not sufficient to completely intermingle the gas and air and make a uniform mixture, but it is in strates or layers. First say a layer, or a foot of air, then a twilight zone where there is a mixture of air and gas in different proportions, starting from pure air to

pure gas, in which you have the excessive mixture. Then following that is a strata of pure gas, and if such a condition takes place it is possible that that portion that I have named the twilight zone should get into a service line and it should be burning, and having gas going through them, that it would go out and would possibly ignite back in the pipe, or, if you have a pebble or foreign substance in the pipe line which would create a spark in the presence of this excessive mixture of air and gas it would set the whole amount off and blow up your system.

Q But the other danger does also exist does it not?

A Yes, it is possible.

Q That the slug of air could put out the fire and then the gas follow up and asphyxiate the family?

A Yes, it is possible.

[fol 231] Commissioner Russell We lost one of our State Senators at Guthrie that way, and nearly lost another.

A That is possible.

Commissioner Russell If you went down to your furnace and found that within the furnace was no flame at all, but heard a spitting back inside the connection to where your stop cock was, what would that indicate?

A That would not indicate the presence of air. That would indicate the pressure had declined to such a point that the velocity of gas shooting through the orifice of your burner was lower than the velocity of the flame and that the flame was following back and burning in the mixer. That is usually what takes place under the conditions you have described. They call it flashing back in the mixer.

Commissioner Russell But if you examined your radiators and found them cold, and when you started in the basement you could hear a good roaring in the furnace, and you open the door and find absolutely no fire, would that indicate a slug of air had come along?

A Not necessarily. It would indicate one of two things. Either an excess of pressure sufficient to have entirely blown out your flame, or it may have indicated that the pressure had diminished to such a point that your flame had gone in the manner I speak of, and then that the pressure had come on again, and that the gas was escaping into your furnace.

Commissioner Russell But if at the time you heard the roaring the gas pressure had not increased as shown by the other stoves in the place. Just flickering along from the time your furnace was burning, and during the time it was not burning, now at the time [fol 232] when you heard the noise in the furnace and no fire, and at other stoves fed through the same pipe, and through the same meter you still have your little small flame, indicating that the pressure has not increased, what would you say?

A Under those conditions I would say you could not hear the roaring. The only source of this roaring would be a sufficient pressure in your pipes to pass the gas out at a rate that would produce the roaring, and unless you had that pressure you could not hear a roaring.

Mr. Richardson: Mr. Weymouth, if the flames had not gone out in his range and in his stoves which were fed by the same service pipe coming to his house, and when the flame had gone out in the furnace, would not the very fact that the flames continued in his stoves and in his burners show that it was not air that was causing the flame to go out in the furnace? Or, that if it was, that it was from the outside, and not the inside of the pipe-line?

A. Decidedly. If he had a fire burning in other equipment, fed from the same source of supply it would be indicative that there was no air in it sufficient to produce that condition in the furnace.

Q. The flame in the furnace might be extinguished by a gust of air coming down the chimney?

A. It very often is extinguished by a back-draft, as it is called, the only thing I could imagine that would produce the roaring would be the flashing back in the mixer.

Q. A very small quantity of gas burning in the mixer makes a roaring, does it not?

A. Yes sir.

Mr. Richardson: That is all.

[fol. 233] Question by Mr. Fulton:

Q. Which is heavier, gas, or air?

A. Air, as compared with ordinary dry natural gas that is supplied here.

Q. How much heavier?

A. The relationship between gas and air is about 64/100, or 62/100, I should say of the weight of the air.

Q. What is necessary to make air and gas mix?

A. The usual way is to pass it into a chamber between the orifice and the burner, and the gas having a certain velocity that makes the molecules or particles, the minute particles of the two substances intermingle by virtue of their velocity.

Q. It takes a certain velocity then, added to one or the other in order to induce them to mix?

A. In the ordinary mixer it takes a certain velocity in order to get the air in, yes. The bringing in of the air is occasioned by the gas shooting from the orifice in the pipe.

Q. That causes a suction?

A. Yes.

Q. That brings the air in there?

A. Yes.

Q. Now how is it they put the pressure on the gas in the pipes?

A. In very many cases the pressure is the natural pressure from the well.

Q. Suppose they want to put in a pressure that is in excess of the rock pressure, that is what it is called, is it not?

A. It is not the rock pressure, it is because of the rock pressure. If the well pressure is not sufficient to deliver the gas through the pipe line, then the pressure must be raised by booster stations.

[fol. 234] Q. How do they operate? Not technically, but briefly?

A. Merely by working a piston back and forth in a cylinder which draws in the gas on what is called the in-let stroke, and discharging it on the out-let stroke, the pressure being raised during the out-let stroke by virtue of the compression of the gas within the cylinder.

Q. If I understand you, they will have a cylinder with this gas in it, and have a plunger in it that shoves the gas out at a certain velocity?

A. The cylinder is connected to the wells by a pipe and as the plunger is pulled out it draws into it the gas that is fed to it by the wells, and on the out-let stroke the valve on the end of the cylinder closes so that the gas is trapped in the cylinder and compressed to a sufficiently high point so that when the gas is delivered it is at a higher pressure.

Q. Are not those stations close to the well?

A. They are at an adjacent point to the well, but they could not have them at each well. They are usually in the field.

Q. Is it not possible when they are compressing that gas to compress air with it?

A. It is physically possible if you reduce your pressure below the atmosphere on the suction side.

Q. That would mix the air with the gas, would it not, by forcing the gas in?

A. That would effect a partial mixture.

Mr. Fulton: That is all.

Questions by Mr. Richardson

Q. How do you suppose that would do when you are pumping that mixture of air and gas through the pipe line with the friction of your plunger working on it, what would be the result?

[fol. 235] A. I don't believe it would be possible to get a man to operate a station under those conditions.

Q. How long do you suppose a man could operate a station under those conditions?

A. Until it was set off.

Q. The friction of the pump working back and forth would set it off pretty quickly, would it not?

A. It might under certain conditions create enough heat to exceed the ignition temperature, and there is also the danger of foreign substances that are unavoidably in a pipe line after it is built producing friction.

Mr. Richardson: That is all.

Questions by Mr. Fulton

Q. It is only dangerous when you have an excess amount of air. It is not dangerous when you have only one part of air to one part of gas, is it?

A. If you are sure you have a thorough mixture of air and gas under those conditions it would not set off, but you could not effect a thorough mixture under those conditions.

Q You stated that when air gets into a pipe line it not necessarily mixes with the gas, but runs along in stratas. How do you know that. Theoretically, or practically, or how?

A I know it from actual experience where air is carried along in a line.

Q Tell us about your experience along that line?

A In one case where a consumer had some high pressure air connected into a line that had a pipe connection over to his service pipe for operating a gas engine, he turned on the high pressure air accidentally and got some air into the service line, and the lines of [fol. 236] some adjacent services, and the effect was that some of those services were put out, and some of them were not. That is, the appliances connected with some of those services, indicating without cavil that the gas did go through in slugs.

Q That did not have very far to go did it?

A It had, I suppose, a couple of thousand feet.

Q Suppose it had to go a hundred miles?

A I never tried it that far.

Q The chances are that it would be pretty well mixed by the time it got to the consumer, would it not?

A No, I think not. I think from similar experiments I have made on oil lines on that particular subject and the laws controlling, or taking into consideration the laws governing the situation in both cases, I am quite convinced it could travel a great number of miles and still retain this stratified condition.

Q Ordinarily, at what rate of speed does gas travel through a pipe line?

A The speed will vary from a very slow velocity up to greater than a mile a minute, depending on the size of the wells, the pressure obtained, and the amount of gas being delivered. It is variable.

Q Which would go the faster, the strata of air or gas?

A They would travel at the same speed under the same pressure conditions.

Q Regardless of the weight of each?

A Yes, the co-efficiency of friction is the same with gas and air.

Q You think if they went at that high rate of speed it would not tend to mix them any more than at a low rate of speed?

A There is, of course, a tendency to mix by virtue of passing [fol. 237] through the line, but my statement is that there is more or less mixture as it travels through, but not sufficient to effect a complete mixture.

Q Why do you say that?

A Because it has been my experience and observation.

Q Did you ever have any other observation except the one you have stated?

A I have had two cases of that sort and I know.

Q How far did it travel after the air got into the pipe?

A In the second instance was a distance of —— comparable with that in the first case.

Q You never have had any actual experience where the air and gas has travelled at a high rate of speed I believe you said about a mile a minute, didn't you?

A. Yes.

Q For as far as a hundred miles?

A. The air and gas you mean?

Q Yes, together?

A I never had any experience with that.

Q You only know theoretically what would be the result under those conditions?

A No, I know practically that that is the case.

Q You only know practically what you have demonstrated, and you know theoretically what you arrive at from deductions and conclusions.

A That is the way we know a great many facts, and yet know, you know.

Q That is what I am trying to get at, whether you know it practically, or theoretically?

A I am perfectly free to admit that I never attempted to put air in a line for the purpose of studying the mixing effect over a great [fol. 238] distance. I would be afraid to attempt such a thing.

Q So your conclusions as to that would be theoretical from what you have learned from your studies and deductions from similar cases?

A Yes, it would.

Mr. Fulton. That is all.

Questions by Mr. Richardson:

Q Mr. Weymouth, suppose there should be a leak in a line on the in-take side of the compressor station so that the compressor in sucking gas from the well for the purpose of pumping it on through a line, would suck in some air through that leak in the line. I want you to tell this Commission what that would amount to with respect to a Company that would deliver all the way from eighty to one hundred million cubic feet a day, and whose pipe lines were connected up with anywhere from twenty-five to thirty different gas wells?

Mr. Fulton. It is impossible for any man to answer a question like that.

Mr. Richardson. I have asked the question, do you object?

Mr. Fulton. I object because it is impossible for any intelligent man to answer it.

Commissioner Russell. The question is how much some air would bring at forty cents a thousand. Any objection to the witness answering the question?

Mr. Fulton. No sir. If he can answer that without knowing how much air went in he is a better mathematician than I think.

Mr. Richardson. I am talking about a leak such as Mr. Rogers described.

Mr. Fulton. You did not say that. You said a leak.

[fol. 239] Mr. Richardson. All right then, I will say such a leak as Mr. Rogers described yesterday.

A Under normal conditions of operation of a compressor station where the suction pressure on the compressor rarely goes much below atmospheric pressure, the quantity of air that would enter into the suction line from a single well as has been described, and in which the gas delivered is of the magnitude indicated by the question, I would say that it would be difficult, if not impossible to detect it by an analysis of the gas.

Q Suppose there is a leak in one of the lines from the well, an ordinary leak that the usual and ordinary care of pipe lines had not found, would it make any appreciable difference in the quality or relative efficiency of the gas?

A In all of the gas operations in most of the large producing fields, any leaks in the line, or in any part of the system, to within a very short distance of the pumping station, would result in gas coming out of the line rather than air going in.

Q Even if you were pulling gas with the compressor?

A Yes, because there is a pressure gradient from the station back to the well. The pressure may be low at the station, but a very short distance away it has risen to a point above atmospheric pressure, and there is always an excess pressure of the gas over the air.

Commissioner Russell I have a question or two I want to ask. Could an appreciable amount of air be drawn in without attracting the attention of the operator of the station?

A I would like to say that in seventeen years' association with the business in which I have been connected with the compressing of natural gas I have never detected any air in the gas from such [fol. 240] source.

Commissioner Russell If an appreciable amount was drawn in, would those operating the plant be aware of it I think that is the question.

A Yes, if a sufficient amount were to enter they would probably be aware of it.

Commissioner Walker In what way Dangerous?

A They would not be aware of the danger until it occurred, but with the manner in which the Commissioner mentioned a while ago, that possibly fire would get out.

Mr. Richardson That is all.

Questions by Mr. Fulton

Q Just another question. I have never seen one of these points they compress the air, but it works on the same principle as any suction pump, does it not?

A Not necessarily a suction pump, and yet that is quite true in the sense that all piston operated pumps can be suction pumps if the compressor condition is such as to make them that way.

Q That pump or propellor is attached to the pipe line in some place, or how is that attached to the pipe line. Explain that in a few words?

A I think I can clear this up. The compressor station is usually

located as near the center of the field as it can be, practically. To that station, through the different field lines to it, the wells are connected and the gas passes. That is, there is a series of suction lines, so called, but really feed lines is a better name for them, which radiate from the compressor station to the wells. At the compressor station the pressure on these feed lines is pulled down, when they [fol. 241] go under low pressure conditions, that is when the wells have delivered the most gas they can under high pressure conditions, the pressure is pulled down to the neighborhood of atmospheric pressure. If you attempt to pull your pressure below that point by means of your compressor you not only endanger the system as we have mentioned but in addition to that you don't get any benefit from that reduced pressure because after you get out a quarter of a mile from your pump station you will find that pressure has lessened very largely in proportion to the total rise of pressure back to the well. In other words, there is pressure maintained from the well to the pump station. At the well it may be 20 pounds, and half way to the pump station it may be 16 or 17 pounds, and within 1-10th of the distance from the pumping station to the well it may be 5 pounds, and as you near the pumping station the pressure drops rapidly.

Q. That is not what I was trying to get at. I was trying to get at some way regarding the mechanical operation of that pump. The only kind of pumps I have ever seen I guess has been these ordinary water pumps. If I have ever seen any other I have never noticed them. If you can give me an idea of how that pump works, that is what I am trying to get.

A. When you pull the piston out on the intake stroke the pressure of water on your supply pipe makes the water flow——

Q. Yes, I understand that——

A. If you were to connect a pump in the basement here with the water supply pipe and were to pull the piston out you would have certain 60 or 70 pounds pressure forcing that water into the pump. When you push the plunger back and the valve closes you raise that pressure from your original 60 pounds up to a hundred, or a thousand pounds, if you wish, and that is precisely the way the compressor [fol. 242] operates only you are dealing with a different medium.

Q. I mean they have different size pumps at these different compressor stations?

——

Q. How many cubic feet of gas would be taken in at one stroke?

A. That all depends on the size of the pump.

Q. That is what I thought. How do they run?

A. They would run from one and a half cubic feet at a stroke up to—let me see.

Q. I don't care to be accurate?

A. Up to fifteen or twenty cubic feet at a stroke.

Q. And that is sent into the main line with what velocity would you say?

A. The velocity at that point,—that would run from two to three thousand feet a minute velocity as it enters the line.

Q. And that goes right in with other gas in that line?

A. It follows the gas that is ahead.

Q. And if they should force air in there with the same amount of force,—or if for one stroke of the pump, or whatever you call it, if they would pump gas one time and the next time suppose it was possibly arranged to pump the same quantity of air in there that there was gas, it would go in the line at the same rate of course?

A. Yes.

Q. Wouldn't that cause it to mix?

A. No, that would produce your stratification, and that would gradually pass along in the line and spread out.

Q. Why would not that cause it to mix. You have gas in your line and you shoot in say ten cubic feet of air at the rate of say—well so many thousand feet a second, why would not that mix it the same way as the air in the mixer on your gas range?

[fol. 243] A. Here is a compressor full of gas and you follow that with another compressor filled with air and follow that with another compressor full of gas. There you have your stratas. As that passes through the pipe and the pressure drops or declines as it does in flowing gas through a pipe line, those stratas spread out in length. There is an intermingling at that point.

Q. I understand where your pencil is was all gas?

A. Yes.

Q. And you have shot air into that gas?

A. No, we have put air in behind that. The whole thing is a moving mass under constant velocity. It is not a series of jumps. The point is there is a place where there is a mechanical mixing.

Q. And it would be possible, would it not, if the company was so inclined, that it could deliberately pump air in there with those pumps?

A. It certainly would be.

Mr. Fulton: That is all.

Mr. Richardson: That is all.

(Witness excused.)

[fol. 244] Bert C. Oliphant, being called as a witness on behalf of the respondent, being first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. You may state your name?

A. Bert C. Oliphant.

Q. Where do you live, Mr. Oliphant?

A. In Buffalo, New York.

Q. In what business are you engaged?

A. The Natural Gas business.

Q. With what Natural Gas Company, if any, are you connected?

A. I am the President of the Iroquois Natural Gas Company, supplying Buffalo, and also the Erie County gas company, and Vice President of the Provincial Natural Gas and Fuel Company, of Ontario, Canada.

Q. How long have you been engaged in the Natural Gas business?

A. I guess I was brought up in it. My father was connected with the Natural Gas business as a consulting and geological engineer, and I got my engineering degree from the Rens-alaer Polytechnical Institute at Troy, New York.

Q. What degree did you take?

A. Civil Engineer and from that time on I have been connected with the Oil and Gas interests, more particularly with the Gas interests and for the last fourteen years I have been connected with Gas interests.

Q. Do you know what the relative heating value of gas at different pressures is?

A. Yes.

Q. Did you, yourself, ever make an experiment or test as to the quantity of gas, as compared with gas at atmospheric pressure that would be delivered through a meter at four ounces pressure?

[fol. 245] A. Yes.

Q. In addition to that have you observed other tests that were made by other people in regard to that?

A. I have been present and caused them to be made, and have made them myself.

Q. Did you see the demonstration that was made this morning by Mr. Weymouth as to the effect of applying a four ounce pressure to a given quantity of gas, which, before the application, was at atmospheric pressure?

A. Yes sir.

Q. Was that demonstration correctly and scientifically made?

A. It was.

Q. And was the result of that demonstration correct?

A. It was.

Q. In order to shorten the question then, I will ask you, by permission of the Commission. Is it true that if you have a container that holds 1000 cubic feet of gas at atmospheric pressure, that in order to raise that gas in that container to one ounce pressure you would have to add only about four and a fraction cubic feet of gas in the container to raise it to one ounce pressure?

A. That is correct.

Q. And about four and two tenths (4.2) feet successively, to raise it another ounce?

A. Yes sir.

Q. Four and two tenths more to raise it to two ounce pressure, and four and two tenths more to raise it to three ounces, and four and two tenths more to raise it to four ounces?

A. Yes sir.

Q. And that the difference between the quantity and the heating [fol. 246] value of gas at four ounces pressure, and as to the density

or quantity and heating value of gas at one ounce pressure is only about thirteen cubic feet of gas out of a thousand?

A That is correct.

Q State to the Commission whether or not a meter will deliver more or less gas at a high pressure than it will at a low pressure?

A It will deliver more gas at a high pressure than it will at a low pressure.

Q And does it register correctly at the low pressure?

A It does.

Q And is the person only charged with what he gets at the low pressure, and is required to pay for only what he gets?

A Just what goes through the meters.

Q Ask you to state to the Commission whether or not if the pressure of gas is only one or two ounces, or we will say one half ounce above atmosphere, that the meter will run faster and register more gas than it will if the pressure is three, or four, or five ounces?

A No sir, it will not.

Q If it did, then it would be a particular meter that needed adjustment?

A It would be out of repair, or something of that kind.

Q But a standard meter, properly adjusted, will not do that?

A No sir.

Q Do you know whether the shortage of gas that existed—the shortage in the supply of gas that existed and was furnished in the months of November and December 1919, was confined only to the Oklahoma Natural Gas Company, or whether or not that shortage was Nation-wide?

[fol. 247] A I know from the Companies that I have charge of that we were short. I know that in Northwestern Pennsylvania, where they brought in those big gas wells that they were short, and from general knowledge and reports that the shortage was Nation-wide.

Q Do you know whether the shortage was so acute and so nation-wide that the Secretary of the Interior called a conference at Washington, on January 15th, 1920, of the Governors, Public Utility men, and Gas Companies, of the various gas producing states to consider and devise means to conserve the Nation's failing supply of gas?

A I do.

Q For an ordinary house of four or five or six rooms, what size supply pipe running from the main to the meter would be necessary to take into that house a sufficient quantity of gas to properly heat it and to be used for cooking purposes?

A I don't think any service line should be smaller than an inch and a quarter, and it would depend on how they were going to use the gas whether you would use larger than that.

Q If one should have an apartment house of about forty rooms, in which twelve families live and in which there were thirteen separate accounts, and thirteen meters, each of those twelve families having two stoves, and a Rudd Water heater possibly, an automatic heater any way, and that apartment house had only an inch and a quarter line from the main into the house to carry gas to supply that

entire apartment house and those thirteen meters and those twelve families, would you say that the supply of gas into that apartment house could possibly be adequate?

A. I don't see how it could possibly be.

Mr. Richardson: That is all.

[fol. 248] Cross-examination.

By Mr. Fulton:

Q. Would the amount of the pressure make any difference?

A. Oh yes.

Q. In other words, you have a larger amount of gas with an inch and a quarter pipe at a four ounce pressure than at one ounce?

A. You could get more through it.

Q. Now what pressure do you generally use in your companies, in the state where you operate?

A. Four ounces.

Q. What do you get for your gas there?

A. Thirty-five cents for the first forty thousand, and all over that, forty cents.

Q. How far do you have to pipe your gas?

A. Well, from the furthest point about 100 miles,—no, I don't mean the farthest, but that is the average distance.

Q. What is the average daily consumption for your companies?

A. The average daily consumption,—do you mean per consumer?

Q. No, for the Company.

A. Well we sell about thirteen and a half billion feet of gas a year. The average daily consumption of course varies much through the winter months.

Q. Now there is quite a campaign on is there not, in this country to conserve gas?

A. There is.

Q. And practically all of the gas distributing companies are back of this movement?

A. They are all in favor of it.

Q. They are preparing to, or already have done so, to inaugurate a campaign of education so that the consumer may be able to reduce the amount of gas which he uses. You heard the testimony of Mr. [fol. 249] Wyer yesterday, did you?

A. I did.

Q. Where he testified that with proper appliances, and proper adjustments the average consumer could reduce his gas bill possibly two-thirds?

A. Yes sir.

Q. And you think that could be done, do you?

A. Well, I cannot say that I am wholly in accord with Mr. Wyer, but I think it could be approximated.

Q. Now as stated by Mr. Wyer, the means of reducing the amount of gas, or the principal means is merely to limit the gas used for

cooking purposes, and that only forms a very small part of the gas that is used, does it not?

A. No, I don't think that is what he said. I think he said heating appliances too.

Q. It is true he said that went to everything, but is it not also true that the improvements, you might say, that he suggested were almost exclusively in regard to the cooking range, along the same lines as demonstrated by the lady?

A. Of course he did not have a furnace here, but he could have demonstrated with a furnace that he could have saved with a furnace as much as on the cooking stove, and could have gotten the heat out of it by the proper appliances.

Q. Do you have any uniform system of furnaces in the cities where you supply gas?

A. We have not.

Q. Is it used to any great extent for heating?

A. It is excepting in the three winter months, and then it is not.

Q. Is it not true that most of the gas companies are starting in to endeavor to ask the people to use gas for cooking purposes only?

A. No, I cannot say that that is the case.

[fol. 250] Q. Well, you agree with Mr. Wyer do you not, that in case the consumer should be able to reduce the amount of their gas consumption two thirds, that would reduce the revenue of the gas companies in proportion, and it would be necessary for them to have their prices raised two thirds?

A. I do.

Q. And you realize that when you get gas which is now sold at forty cents a thousand, raised to a dollar and twenty cents a thousand, there would not be much gas used for heating do you not?

A. I do.

Q. So really the effect of this campaign that is being waged under the name of Conservation, is for the purpose, or one purpose at least, to induce the people to rely upon gas only for cooking purposes. Does it not resolve itself into that?

A. No, I don't think so. I think this campaign is put on to preserve the natural gas fuel and to prolong its life. You have got to face this question. If we go on using gas in the wasteful manner we have in years gone by it will only be a short time until you are using artificial gas.

Q. And it is true if it goes on at this rate, you will get where you are getting say 35 cents per thousand cubic feet, if this campaign is carried out successfully, you will get $1.05 per thousand cubic feet. It makes that difference too, don't it?

A. If we cut the amount of sales down so that at the rate we were getting that we were losing money on 35 cent gas, and it was conserved to that extent, undoubtedly we would have to get more money for it.

Q. Certainly that would be the result. If people cut down their gas bills 75 per cent and—you are only making a fair return on your investment now are you?

[fol. 251] A. That is all. Not making that.

Q. I assumed you would not say anything else. And in order to make a fair return you would have to increase your price of gas 75 per cent?

A. That is true, but on the other hand, if you don't conserve it it will soon be gone, and the only way is to make it worth saving, to make the consumer and the companies realize that it is worth conserving. If gas was worth $1.00 per thousand they would have much more incentive to look after their lines and keep them from leaking than if it is worth only 30 cents.

Q. If they should reduce the amount of their consumption 75 per cent, it would tend, in the same period, to increase the length about three times what it would be if it kept on this way?

A. Yes sir.

Q. So we would have this result. If I remember correctly, Mr. Wyer said under present conditions the present supply would continue about fifteen years?

A. About that.

Q. Well, if we have this method of conservation that is being agitated, and if it works out as contended, it would increase it to 45 years. That would be one thing. We would have gas for 45 years, and the gas companies that are now getting 40 cents for their gas would get $1.20 for it, and the consumer who is now paying 40 cents for his gas would be paying $1.20 for it, and instead of the company being able to sell gas for 15 years at 40 cents, they would sell it for 45 years at $1.20?

A. I don't know. We have not the saying of what we can get for our gas, that would be a question for the Commission.

Mr. Fulton. That is all.

[fol. 252] Mr. Rogers. May I ask a question? Say a monkey stove is connected with a $^3/_8$th pipe with a Globe valve. Run it right up to a burner and the flame comes up this high in the stove (indicating) is the people who do that, are they robbing other people of gas when the gas is low?

A. I don't see how people could do that when the gas is low.

Q. Well you are my landlord and keeping up my expenses and you leave me down here and don't pay any attention to my expenses, and my gas bill is handed to you and you pay it and no attention is paid to it, and I don't care anything about it, I just do that. Now is that agin the law?

A. I am not an attorney, I don't know.

Q. Well such things come up and I thought you might know.

A. I cannot answer your question.

Q. I say are they robbing people on the line, pulling gas out that way? Pulling it out so fast?

A. If gas is low everybody is low. We all have to go down together unless you are low on account of improper appliances.

Q. Well if a man opens up the line that way through a $^3/_8$th pipe he is robbing the gas line ain't he?

A. Let me understand you.

Q. There ain't no air mixed in it, it just comes up on the outside

and is mixed afterwards. Comes right out of the pipe instead of going through a mixer.

A. Is he paying for the gas he is burning?

Q. He told me he sent it in to the company.

A. If he is paying for it he is robbing himself.

Q. There is a man doing that and the company is paying for it here in the city. What I want to find out is whether they are burning so much gas doing that way that he is robbing other people.

Commissioner Walker: The latest style of robbing is to put these [fol. 253] little vacuum pumps on.

Mr. Rogers: The question is whether they are trying to rob people who want to use gas.

A. No, I don't see how he is. There is only so much gas that will go through that $\frac{3}{8}$th pipe. He is burning more gas than he would if he mixed it properly. He is not getting the heat or the results from it that he would if it was properly mixed.

Q. By having a three eighths pipe instead of a little pin hole he burns that many times more gas.

A. I think he must be very flush. I don't know the conditions under which he is using it, but if it is for cooking it must blacken his pots and vessels. If he is heating with it in the room it must sweat the house and steam up the windows.

Q. Would it take many such appliances to rob other people who was trying to use gas right in their stoves?

A. Why I don't—I can't conceive in the first place of anybody doing that. That would be the same thing as a leak in the line.

Q. But you go on down the line the gas will keep getting weaker as you go on down until it is no gas for any people at all.

A. That is true if it is a dead end line.

Questions by Mr. Richardson:

Q. Are you familiar with the Rudd water heater?

A. Yes sir.

Q. Do you know whether or not those heaters use about 250 cubic feet of gas an hour?

A. I think that is about the average capacity of them, yes.

Q. Suppose you have a Rudd water heater in a house connected with an inch and a quarter line, that is, the line from the main [fol. 254] coming into the house, and that line is 40 feet long. Suppose that gas is furnished at a six ounce pressure from the main, and three ounces at the heater. Would that water heater take about the entire capacity of that inch and a quarter line?

A. Yes, I think it would. There might be some little over but it would very near take it all.

Q. In this forty room apartment house, if in addition to the twelve families furnished with gas, making twelve accounts, and twelve meters, this Rudd water heater is also connected with it on another meter, and the service line is forty feet long, when that Rudd water heater is running, would anybody else get any gas?

A. I would not think so, and I think under the conditions of the case if a person had a pretty good supply and that water heater automatically went on, it might put the other fires out.

Questions by Mr. Fulton:

Q. Why would more gas go there than to any other opening?

A. On account of the size of the opening on the Rudd water heater with the gas being larger the gas has a freer escape, it comes out quicker.

Q. And if they were all lighted at the same time it would draw more gas than the other openings would?

A. Yes sir.

Mr. Fulton. That is all.

(Witness excused.)

[fol. 255] A lady appears in the court room.

Crosby is my name. Of course I was told it would not be an intrusion if I should come in here this afternoon, or I should not have come. I came for another purpose to the Capitol and was disappointed in seeing who I wanted to see, and so I concluded I would hunt up some of the Corporation Commission, and I don't know a one of them. I know their names is all. But I would like to say something about those—what do you call them, pressure guages, that were placed around over the city, and of course I am not wanting to criticize the work of the Corporation Commission in any respect whatever, and I feel if it was not for them I don't know what we would do sometimes, but I am afraid, for some reason or other, they have not made the reduction charge enough. I live at 424 East Sycamore, out in East Capitol Hill. I have a small house where my daughter and I live together, and I have only two stoves, a cook stove and a good heater, and during the cold weather in November, and also in a part of December, and also in part of January, at 8:30 in the morning, just almost as regularly as that time came, out goes my heater, voluntarily, and there is not a bit more gas there until about 9:30 or 10:00 o'clock at night, and as we retire early, we get no use of it after 8:30 in the morning. I have a new cook-stove, as good as anybody has, I think, and after 9:30 in the morning, all this time I could not even heat a tea kettle, could not boil a kettle of water with all the pressure turned on that I could get, and in November when we had this very cold time I frosted my feet in the house because I was unfortunate in not getting coal before the strike, and I was out of coal, could not get it, and I frosted my feet in the house, and I went around the house in November and December, and part of this month, with a great big coat on because it is still [fol. 256] hard for me to get coal. It is hard for me at least because I have not always got the money. Now when you can't even boil a tea kettle I think the gas reduction should be about fifty per cent

because as I understand it we pay for a good deal of air, and it is not hot air either but cold air during this time.

Commissioner Walker. You would not kick if it was hot air?

Mrs. Crosby. No, I wouldn't mind it a particle. I have tried three different times at the offices of the Oklahoma Gas & Electric Company to pay my December bill because I would like to keep my bills paid and of course they said I could not pay it. I understood from the paper twice, that I could, but they said the papers knew more about it than they did, and it would have to be decided by the Corporation Commission, and the last time I was there, it was seven or eight days ago, why the new adjuster he said I can't figure it up for you, that doesn't apply, but of course if you want to you can wait until the decision of the Corporation Commission and as they are the law in the matter we have nothing to say. Well I said figure it up please, I don't like to have those things hanging fire and the little gas I burn in my stove does not amount to very much anyway and the reduction would not amount to much in my direction but I don't believe anybody should be imposed upon. He figured it up, and it was just exactly what the bill was for originally, penny for penny with the bill that was originally sent out with the ten per cent reduction for prompt payment, and I said if I don't get any reduction I won't pay it. I said now I don't want you to take my meter out, and he said Oh no, we don't dare to do that. I said I need it. So my December bill has not been paid. I want to thank you gentlemen for this [fol 257] privilege for I was not expecting it.

Questions by Mr. Fulton:

Q. You say the figures were alike?

A. Yes, the original statement for it was only $4.40. You see I only use the cook stove, and I could not use it after 8:30 until about 9:30 at night, or ten o'clock, because it would go down so low that I could not even boil a tea kettle of water on it.

Q. How many hours would it be out?

A. I get up about 5:30 in the morning, and then you see the News published recently the reduction that each location in the city would get, and ours was only 15 per cent. Fifteen per cent, nothing, it should have been at least fifty. I am not kicking about any little gas bill, but I would like to have some service if possible.

Q. That was your bill for what month?

A. December.

Q. That was for the gas used in December?

A. Yes.

Q. What was your bill for December last year, do you remember?

A. No, I don't.

Q. Do you know how this compared with December of last year?

A. No, I rid my desk not long ago and threw away all those old bills. That was sometime before this trouble came up.

Q. You don't know whether it was larger or smaller than your bill for December last year?

A. No, I don't, but I know I had a sick daughter in the house that time and I burned my heater all day long and part of the time all night. That was a year ago, and now we simply cannot do that.

Q. Do you remember how much your bills run?

A. I don't remember exactly. That December and January, which [fol. 258] included a part of February—I don't remember what it was. This December and January, which included part of both these months it was between nine and ten dollars.

Q. That was when you used it all the time?

A. Yes. Of course, I say this bill is nothing. It is not the little bill that I am kicking about.

Q. The reason I asked the question, so many people have complained of the poor service and say their bills are as large as they were before?

A. Now of course, I used my stove so much more then than I do now. There is just the two of us. My daughter works, and she is not at home for lunch at all and I am not above eating something cold if I can find it good.

By Mr. Owen: I would like to have the lady meet me at the office and go with me to the man that figured the bill and let's find out whether or not he figured what the discount would be from the net amount of the bill. That is what their instructions are and I am confident that is what he did. That is what our instructions are and I am confident that is what he did. I am sure we gave no such instructions and don't think any of our men would act in that way. I don't think he did that.

Mr. Richardson: You say when he figured the bill it was exactly the same, with the ten per cent discount?

A. Yes sir.

Q. He told you that he was not figuring the discount, that is the discount that the Commission had ordered made because of the inadequacy in the supply of gas because that was not to be figured until after the hearing was had before the Commission, didn't he?

A. I told him what our locality discount would be according to [fol. 259] the way it was published in the News and he said "I am not figuring anything for the Corporation Commission, I am figuring for the Oklahoma Gas & Electric Company."

Q. And he told you they were not making those discounts, or rebates until *after* the matter had been *heard* before the Corporation Commission?

A. But as I understood what I had read of the Corporation Commission's ruling, I had understood that we were to get the benefit of the discount also, and he said no. You get no benefit of the discount.

Q. That is what I am getting at. He told you that you would not get the benefit of that discount until after the matter had been heard by the Corporation Commission?

A. Yes.

Q. So if he figured your bill at that time, the only way he figured the bill would be what it was with the usual ten per cent discount?

A. Certainly.

Mr. Richardson: That is all.

Mr. Russell: Our purpose is to get some reliable service if it can be done.

Mrs. Crosby: Well if I have to go back to using old black coal I want to know it.

(Thereupon Mrs. Crosby was excused.)

[fol. 260] HARRY D. HANCOCK, being called as a witness on behalf of the respondent, Oklahoma Natural Gas Company, being first duly sworn, testified as follows:

Direct examination

By Mr. Richardson:

Q. Mr. Hancock, give the Commission your name, please sir?

A. Harry D. Hancock.

Q. Where do you live, Mr. Hancock?

A. I live in New York.

Q. What is your business?

A. My business is that of Gas Engineer.

Q. How long have you been connected with, or engaged in, that business?

A. Eight years.

Q. What education along that line did you have?

A. I am a graduate of the Engineer Department of the University of Missouri.

Q. With what gas companies have you been associated since that time?

A. The Denver Gas and Electric Company of Denver, Colorado, the Lincoln Gas & Electric Co., of Lincoln, Nebraska, The Bristol Electric Light and Gas Company, of Bristol, Tenn., The City Light and Traction Company of Sedalia, Missouri, and since that time—those companies which have been named, I worked for in various capacities, and since that time I have been engaged in a consulting and advisory capacity for the following companies: The Montgomery Light and Water Power Company, of Montgomery, Alabama, the Knoxville Gas Company of Knoxville, Tennessee, the Lebanon Gas and Fuel Company of Lebanon, Pennsylvania, the Republic Light and Power Company of Tonawanda, New York, the Spokane Gas and Fuel Co., of Spokane, Washington, and the Pueblo [fol. 261] Gas and Fuel Co., of Pueblo, Colorado, and various smaller companies.

Q. With what company are you now connected?

A. Henry L. Doherty & Co.

Q. Mr. Hancock, did you ever make a test or demonstration as to the relative quantity and heating efficiency of gas at four ounce pressure as compared with the same measured quantity of gas at three, two, and one, and fractional ounce pressure?

A. I have.

Q. Suppose that a gas company has five different patrons located in five different portions of this city. That it meters to each patron 1,000 cubic feet of gas; the first patron gets his 1,000 cubic feet of gas at four ounce pressure; that it meters to the second patron his 1,000 cubic feet at three ounces pressure; that it meters to the third patron his 1,000 feet of gas at two ounces pressure; that it meters to the fourth patron his 1,000 feet of gas at one ounce pressure; and that it meters to the fifth patron his 1,000 feet of gas at one-half an ounce pressure. I will ask you to state to the Commission what the relative quantity of gas of each of those consumers would get as compared with 1,000 cubic feet of gas at atmospheric pressure, and what number of relative heat units each consumer would get?

A. Speaking in terms of gas at atmospheric pressure, the first consumer receiving his gas at four ounces will receive in round numbers 1,017 cubic feet, the second consumer receiving his gas at three ounces pressure will receive 1,013 cubic feet, the third consumer receiving his gas at two ounces pressure will receive 1,009 cubic feet, the fourth consumer receiving his gas at 1 ounce pressure will receive, in round numbers 1,005 cubic feet, and the fifth consumer receiving his gas at one-half ounce pressure will receive 1,002 [fol. 262] cubic feet of gas. These consumers will receive an amount of heat in the same proportion.

Q. That is, they would receive that number of heat units?

A. They would receive that identical number of heat units, assuming that each 100 cubic feet of gas contained 1,000 B. T. U.

Q. Do I understand if you have a container holding 1,000 cubic feet of gas and you fill it with gas at atmospheric pressure, that would mean that the pressure on the inside of the container was exactly equal to the pressure on the outside, is that correct?

A. Yes sir.

Q. And in order to raise that to four ounces pressure you would have to add 17 cubic feet of gas?

A. Yes sir.

Q. And that the difference in quantity and heating value of the gas at atmospheric pressure and four ounces is just such heat as 17 cubic feet out of 1,000 would make, is that correct?

A. That is correct.

Q. And the three ounce pressure would be such as 12 cubic feet of gas would make?

A. According to my calculation it would be 13.

Q. And at two ounce pressure it would be such difference as how many feet of gas would make?

A. Nine.

Q. And at one ounce, as how many feet would make?

A. Five.

Q. And at one-half ounce?

A. Two cubic feet.

Q. Mr. Hancock, state to the Commission whether or not it is true that a gas meter will register faster while gas is being delivered [fol. 263] at a low pressure than it will at a high pressure?

A. It will register faster when gas is being delivered at low pressure than at high pressure only in the event that more gas is passing. In every case it will register the amount passing.

Q. Will the same quantity of gas pass through a meter in less time at high pressure or at low pressure?

A. That depends upon the opening at the outlet of the meter.

Q. Say the opening is constant. You have two meters, the openings are the same, the meters are the same, the pipes are the same, and the only difference is that gas is being passed through one meter at say four ounce pressure, and through the other at one ounce pressure?

A. The meter receiving the gas at higher pressure will pass more gas under those conditions.

Q. And will it register more?

A. It will register the amount that passes.

Q. So while the meter receiving the gas at lower pressure will pass a smaller quantity of gas in the same length of time than the meter receiving the gas at a higher pressure, yet the meter at low pressure will register only the gas that actually passes, is that true?

A. That is correct.

Q. Are you familiar with the pressure that is maintained on the lines of the—is it the Kansas Natural Gas Company at Ottawa?

A. It is a distributing Company, supplied by the pipe lines of the Kansas Natural Gas Company.

Q. Who owns the distributing plant at Ottawa, Kansas?

A. The Ottawa Gas and Electric Company.

Q. Ask you to state to the Commission at what pressure gas is being furnished at Ottawa, Kansas?

[fol. 264] A. Gas is being furnished at Ottawa, Kansas at $1\frac{3}{4}$ ounce.

Q. Is that the pressure at the regulator stations?

A. At the present time the pressures are in process of readjustment, and only a portion of the town is working under the $1\frac{3}{4}$ ounce pressure.

Q. What is the other portion working on?

A. Eight ounces.

Q. Ask you to state what kind of service the consumer gets who has the $1\frac{3}{4}$ ounce pressure?

A. The service to the consumer where he is using gas at $1\frac{3}{4}$ ounce pressure is much better than was formerly secured when using gas at higher pressure.

Q. Do the consumers who are using gas at $1\frac{3}{4}$ ounce pressure, are their homes properly heated and their meals properly cooked?

A. They are.

Q. And within a reasonable and proper length of time?

A. They are, and the consumer expresses himself as satisfied and pleased with this arrangement.

Q. I will ask you to state to the Commission if that has been accomplished by the installation of proper appliances for the consumption of the gas and the burning and utilization of it?

A. In practically every case the use of the $1\frac{3}{4}$ ounce pressure was

preceded by the raising of the burners on the ranges to conform to the recommendations which were made by Mr. Wyer.

Q. Do they also utilize gas for heating purposes?

A. They do.

Q. And they use that at $1^3/_4$ ounce pressure?

A. They do.

Q. Is that efficient for heating their homes?

A. It is.

Q. How far north of Oklahoma City, is Ottawa, Kansas?

[fol. 265] A. I am unable to give the exact distance——

Q. I know, but approximately. It is at least two or three hundred miles, is it not?

A. I should say between two and three hundred miles.

Q. Therefore the temperature would be lower there than here?

A. I would anticipate it was.

Q. The weather would be colder there because it is further north. This is two or three hundred miles south of there?

A. Yes, I think their weather would be more severe there.

Q. Do you know how the arrangements are made for heating their homes with gas at $1^3/_4$ ounce pressure?

A. The consumers in Ottawa have a number of gas furnaces, but the larger part of the heating is incidental heating. Although a very large proportion of the homes are heated exclusive with gas, and successfully heated under the arrangement which I have previously described.

Q. Now that necessitated, did it, the installation of proper appliances for the proper combustion and utilization, proper combustion of the gas, and proper utilization of the heat which that combustion engendered?

A. It necessitated in most cases the re-arrangement of existing appliances.

Q. But did not necessitate the buying of new appliances?

A. Only in cases where the former appliances were in such shape as would require an excessive amount of labor and material to change them.

Q. Now for instance, take a range for cooking. That result could be accomplished by an adjustment of the burners without having to buy an entire new range, could it not?

A. Yes, it could.

Q. And also with respect to furnaces and stoves for heating pur-[fol. 266] poses, is that true?

A. It is.

Q. Have you seen that in actual operation, and do you know that state of facts exists there?

A. I have. I have assisted in the work which I have described.

Q. What is the price for gas in Ottawa, Kansas?

A. The Ottawa Gas & Electric Company is now collecting an interim rate of $1.00 a month service charge, plus 65 cents per thousand cubic feet for gas.

Q. Do you know what the prevailing pressure is in the city of Kansas City, Missouri?

A. I do not.

Q. Would the cost to fix those ranges and furnaces and heating stoves be excessive to the consumer?

A. In most cases it would be a very reasonable amount as the only work that is necessary to put them in proper shape for efficient utilization of the gas is the raising of the manifold in the front of the stove which is accomplished by punching another bolt hole and raising the brackets to the proper height.

Q. How much on the average, do you suppose it would be to each family to fix their appliances in that way?

A. I should estimate with efficient workmen it would not cost more than five dollars to make such a change on the average range.

Q. And that would be saved to the average family in one week's bill during the winter time, would it not?

A. In some cases I believe it would be saved in as short a time as one week, but ordinarily it would probably take a little longer time [fol. 267] Q. What is the population of Ottawa, Kansas?

A. Approximately 10,000.

Mr. Richardson: You may cross-examine.

Cross-examination.

By Mr. Fulton:

Q. What is the average bill in Ottawa for gas used for cooking purposes where there is one range?

A. I have not that information available.

Q. Would it run as much as $20.00 a month?

A. No sir, it would not run as much as $20.00 a month.

Q. What would you say then there was?

A. For cooking purposes and water, I would estimate——

Q. No, just for cooking purposes. Just the range itself?

A. For cooking purposes only, I would estimate that the monthly bill would not exceed $4.00.

Q. And yet they could save $2.00 a week by making this change?

A. In a great many cases they would save approximately one half of their former bill, and in other cases they would save two thirds.

Q. Well now you have stated it would cost five dollars to make the change, and in some cases they could save that in one week. How could that be when their entire gas bill is only five dollars a month?

Mr. Richardson: You limited him to cooking stoves.

Mr. Fulton: That is what you did.

Mr. Richardson: I did not, I said winter bills.

Q. Well let's see, how much would it cost the average family to change the average range to give efficient service under $1^{3}/_{4}$ inch pressure,—I mean ounces?

Mr. Richardson: $1^{3}/_{4}$ ounce pressure.

Mr. Fulton: Yes, that is what I meant.

A. In average cases, with efficient workmen the cost of doing that [fol. 268] work should not exceed five dollars.

Q. That is for the range alone?

A. Yes sir.

Q. I understood you to say that a while ago, and you said in some cases that could be saved in one week?

A. In some flagrant cases that could be.

Q. In that case they would use or burn twenty dollars worth of gas a month on the cooking range?

A. That is possible.

Q. But the average is about $4.00?

A. Yes.

Q. So it would take about a month to save that then?

A. Yes.

Q. How much would it cost to change the furnaces?

A. That would be very difficult to answer because conditions vary so widely. Where a furnace designed to burn coal is encountered it is impossible to shape that furnace for the efficient use of gas.

Q. What do you call a furnace,—or describe a furnace that has been put in exclusively for gas. How are they constructed?

A. They are constructed with a very long travel of the heating products of combustion that ample opportunity for an exchange of the heat contents of this product of combustion to the heating air which will pass in to the house.

Q. Give an every-day explanation of a stove constructed that way. Not a theoretical explanation.

A. In the average coal furnace the space for the heating products of combustion will be between four to six feet before entering the flue pipe. In a correctly designed gas furnace this pass for the heat- [fol. 269] ing products of combustion will be five or six times this length, and the products of combustion will be discharged at a much lower temperature than in the coal designed furnace.

Q. Let's see if I understand you. One house that I had a new furnace was put in. It was an ordinary coal furnace. They put in a blow pipe on each side. You understand, that is what I call it, a blow pipe. I don't know whether that is the technical name or not. What would be the effect of that?

A. The whole furnace would be defective if it was designed for coal because it would be impossible to secure a proper transfer of the heat from the gas to the air or where you are trying to heat by water or steam.

Q. Why? That is what I don't understand. It was a furnace, I could not give the size of it, but it was used for an eight room house, supposed to heat an eight roomed house.

Mr. Richardson. Could you illustrate in any way?

A. In order to transfer heat from one gas to another it is necessary to effect sufficient contact between the two gases. In the hot air furnace, the heat products of combustion will pass along one side of a sheet iron surface while the air to be warmed is passing on the other side of this same sheet iron surface. If that passage is for a

short distance only, a small amount of heat transfer will take place. If it passes for a long distance the two gases will obtain almost the same temperature and all the heat will be abstracted from the products of combustion.

Q. On account of my lack of knowledge of technical terms, I don't understand that at all. Where does the combustion take place? Maybe I am so ignorant that you can't get down to me.

A. The combustion takes place very soon after the gas issues from the burner.

Q. In other words, I remember particularly in that furnace of [fol. 270] mine for instance, here is the bowl of the furnace, and a blow pipe coming in here, and it had a business on the end that made the gas roar. The flame seemed to be right in the center. Was that when the combustion took place. That was when it was on real strong?

A. Yes, that was where combustion took place.

Q. Do you say the distance from that up to the hot air pipe determines the amount of heat you get?

A. That is a very important factor in determining the efficiency of a furnace.

Q. And it should be much further than is arranged for in the ordinary coal furnace?

A. It should.

Q. And it is the distance it goes more than the particular form of arrangment that they may have inside the furnace?

A. That also is important in securing proper combustion.

Q. How do you get that distance when you get—for instance the furnace I have now is down at the bottom. It is made solely for gas. Right down at the bottom there is a ring around the bowl and the gas shoots up around that?

A. Yes.

Q. How would you change that?

A. Can you describe your furnace further than that. What heating arrangement is there above?

Q. It is that thick cast iron stove (indicating thickness) I would say, and instead of being sheeted in with iron it is bricked in, and across the top it has the pipes that are heated, right over the stove.

A. The most efficient furnace with which I have come in contact the gas is led through a series of baffles through long travel, and in indirect contact throughout its travel with the air to be [fol. 271] heated.

Q. For instance in the furnace such as I have illustrated, would you get more heat with, or without putting in fire brick?

A. Do you mean placing the fire brick above the flame?

Q. Yes. To have the flames intermingle with the fire brick, or those nuggets they put in there?

A. It is a house furnace you are speaking of?

Q. Yes, my residence?

A. It would be very difficult to answer that question, but in any event the placing of this refractory material in there would not make

a highly important variation in the amount of heat you would obtain. I think it might make some.

Q. What is the comparative difference between the length of time that a given number of cubic feet of gas at atmospheric pressure, and at four ounce pressure, that it would take to run through the meter. Take 1,000 cubic feet of gas at atmospheric pressure, and 1,000 cubic feet of gas at four ounce pressure, what will be the difference?

A. The only way that gas will move through the meter is to have the pressure at a given point a little higher than at some other point further along the line.

Q. So atmospheric pressure would not put it through the line at all?

A. No sir.

Q. All right then take one half ounce, and compare that with four ounces. How much longer would it take gas at half an ounce pressure to run through than gas at four ounces, or would it be any longer?

A. Under the same conditions of operation in both cases that you have just mentioned, it would take approximately three times as long to run through the gas at one half ounce pressure as it would [fol. 272] at four ounces pressure.

Q. Take $1^3/_4$ ounces, how much longer would it take to run through than it would at four ounces. Oh, just approximately, I am not asking you to be exact?

A. It would take approximately two thirds of the time.

Mr. Richardson: For what?

A. For a given quantity to pass at $1^3/_4$ ounce pressure as compared with the same quantity at four ounces.

Q. In other words, the $1^3/_4$ would be one third slower than the four ounces, is that right?

A. It would take one third of the time for this quantity of gas to pass at one half ounce pressure.

Q. I am trying to get at the comparative rate between $1^3/_4$ ounces and 4 ounces. How much longer will it take $1^3/_4$ ounce gas to pass through the meter than it will at four ounces. The same quantity?

A. I am sure I misunderstood your question, and if I may, I will state my answer in this way. That under four ounce pressure we will pass 1,000 cubic feet of gas in a given time; under $1^3/_4$ ounce pressure, in round numbers, we will pass approximately 600 feet in the same time, and under one half ounce pressure you will pass approximately 350 feet in the same length of time.

Q. At what pressure would you pass the 600 feet?

A. At $1^3/_4$ ounces. That is, in round numbers. I have not figured it out exactly.

Q. In other words, in the time it would take to pass 1,000 cubic feet of gas at four ounces, you would pass only about 600 feet at $1^3/_4$ ounce pressure?

A. That is approximately correct.

Q. That is a little more than,—or not quite twice as fast for

the four ounce. Now it is the heat units, what we call heat units [fol. 273] that give you heat?

A. Yes sir.

Q. The more heat units you have, the more heat you get?

A. That is correct.

Q. Now as I understood one witness who testified this morning, I have forgotten his name, I took it down, he stated that in each cubic foot of gas where there was 1,000 heat units at atmospheric pressure, there would be 1,017½ heat units at four ounce pressure, is that correct?

A. That is substantially correct.

Q. In other words 17 more heat units at four ounce pressure than at atmospheric pressure in each cubic foot?

A. That is correct.

Q. And at two ounces, as compared with four ounces, there would only be between eight and nine difference in the heat units?

A. That is correct.

Q. That is so small it would be scarcely noticeable would it not?

A. It would not be noticable.

Q. Now the lady who testified in the dining room yesterday, stated that it was impossible, if I remember her testimony, to cook supper at one half ounce pressure, and I think the testimony is that it is impossible to heat satisfactorily at one-half ounce pressure, but there is so little difference in the amount of the heat units you get, that it is due to the rate at which it comes through the meter, is it not?

A. That is correct. It is the amount of gas which is there which produces the heat and not the pressure at which the gas is delivered.

Q. And yet you say you can get the same satisfactory, or really [fol. 274] more satisfactory and better service from gas which flows through at the rate of 600 feet in a given time, as you can where is flows through at the rate of 1,000 feet in the same length of time?

A. I do not recall stating that we would get the same service from gas that flowed through at 600 feet as compared with that of 1,000. I said gas would flow under like conditions at those pressures.

Q. I understood you to say you had better service at Ottawa Kansas at 1¾ ounce pressure than you had at a higher pressure?

A. That is correct.

Q. Well now the higher pressure there is—it is difficult for me to state this question properly, but at the four ounce pressure it would go through almost twice as fast as at 1¾ ounce pressure, say in a given space of time, you would have almost twice as many heat units?

A. If this consumer desired 1,000 feet of gas it could be delivered to him at 1¾ ounce pressure.

Q. But it might take a year to go through so he would not have any heat.

A. If he desired 1,000 feet of gas within a given interval of time

his appliances could be adjusted to deliver that amount in that length of time.

Q. In other words, you say the instruments can be adjusted so that at $1^3/_4$ ounces it will deliver the same amount of heat units as they would at four ounces pressure?

A. That is correct. The amount of gas delivered does not depend entirely upon pressure, but upon the opening through which the gas passes at those pressures, and in the comparison which I made we assumed that the openings were constant, and the pressure changed. Therefore, the amount of gas flowing changed.

[fol. 275] Commissioner Russell: But if you went out to give more of the heat units, and everybody made bigger openings then everybody would be short again?

A. Yes sir.

Mr Fulton: You heard the witness on the stand who immediately preceded you. Counsel asked him a question based upon this apartment house where this gentleman to your right lives, where there was—what was that hot water heater,—the Rudd heater, and he testified that it would take up practically all of the gas, you heard that testimony did you?

A. Yes.

Q. You thought that statement correct under the statement that was made?

A. That would conform to the normal operation in installing service. Such a heater would consume practically the capacity of his reporter service line.

Q. Could you account for where the gas comes from that they charge these other people on their bills?

A. That Rudd heater was probably in operation only for very short periods of time.

Q. My recollection was it was in operation all the time?

Mr Richardson: The heater is automatic and only burns when you turn on the water.

Mr Rogers: There is a little hole, a little pilot light burning all the time, and whenever you draw water, open the faucet it opens the gas and lights it.

Mr Fulton: They tried to introduce that testimony to show that it takes all of the gas, or that it would take about all of it. If they want to take the position that it only works a little while and don't take all of the gas then there is nothing in their position. That is all with this witness.

Mr. Richardson: That is all.

(Witness excused.)

[fol. 276] EDWIN DE BARR, being called as a witness on behalf of the respondent, being first duly sworn, testified as follows:

Direct examination:

By Mr. Richardson:

Q. Doctor, you may state your name?

A. Edwin De Barr.

Q. You occupy the Chair of Chemistry in the University of Oklahoma, do you not, Doctor?

A. Correct.

Q. How long have you been filling that Chair?

A. Since the first of September, 1892.

Q. Did you ever occupy a similar position in any other institution of learning?

A. Not exactly the same one, I do now, no. I have been connected with the Alfred College of Michigan and have done a great deal of graduate work in institutions in America, the Michigan Agricultural College, and several other foreign institutions.

Q. Where did you obtain your education?

A. Michigan University, Michigan State Agricultural College, and Michigan State Normal College.

Q. You took degrees in those institutions, did you?

A. Yes, two or more from each one.

Q. And what were those degrees, Doctor?

A. I think about all. Ph. D. M. S. as well as some Bachelor degrees, and two educational degrees.

Q. M. S. is Mechanical Science?

A. No sir, it is Master of Science, and the other is Doctor of Philosophy.

Q. Doctor, have you ever made a test as to the relative quantity of gas contained in a given container at different pressures?

[fol. 277] A. Yes sir.

Q. In order to shorten the record, with the permission of the Commission, and the Attorney General, I will ask you whether or not it is true that if a container holding 1000 cubic feet is filled with gas at atmospheric pressure, that in order to raise that gas to four ounce pressure, it is necessary to add to it only 17 cubic feet of gas?

A. That is correct.

Q. And to raise it to three ounces pressure, it is only necessary to add about 12 cubic feet of gas?

A. 12 in round numbers. 12 or 13.

Q. And to raise it to two ounces pressure it is necessary to add to the quantity contained in the container at atmospheric pressure only about eight cubic feet?

A. Eight or nine.

Q. And to raise it to one ounce, it is necessary to add only about four or five cubic feet?

A. Yes sir.

Q And to raise it to one half ounce pressure, it is necessary to add only about two or two and a half cubic feet?

A That is correct.

Q Did you see the demonstration which Mr. Weymouth made this morning, when he had the gas at atmospheric pressure and by applying some pressure and raising it to four ounce pressure, it decreased the volume only about one and one half per cent?

A I saw the experiment.

Q I will ask you to state whether or not the demonstration was a proper, correct, and scientific test on that question?

A Thoroughly scientific.

Q And was proper and correct?

A Yes sir.

[fol. 278] Q And was the result obtained, a true and correct result?

A The results were correct, yes sir.

Q Then Doctor, I want to ask you this. Suppose a gas company engaged in public service has five different patrons located in five different districts in the city and to each of those patrons in the same length of time it furnishes 1,000 cubic feet of gas. To the first patron it furnishes that 1,000 cubic feet of gas at four ounce pressure, to the second patron it furnished 1,000 feet of gas at three ounce pressure, to the third patron it furnished 1,000 feet of gas at two ounce pressure, to the fourth patron it furnished the 1,000 feet of gas at one ounce pressure, and to the fifth patron it furnished the 1,000 feet of gas at one-half an ounce pressure. What would be the relative quantity of gas as compared with gas at atmospheric pressure, and the relative number of heat units which each of those patrons would receive?

A Assuming on the basis of 1,000 heat units, and on the basis of the increased amount of 17, 13, eight or nine, five, and two and a half, it would be in the same ratio. 1017, 1013, 1009, or 8½, 5, or 4 or 5, and 1002½, to 1,000.

Q As I understand you, the first patron who received his 1,000 cubic feet of gas at four ounces, would obtain a quantity of gas, which, if reduced to atmospheric pressure would amount to 1,017 cubic feet?

A Correct.

Q Or in other words, he would receive 1,017 heat units?

A Every time the 1,000 at atmospheric pressure contained 1,000 heat units, yes sir.

Q And the patron who received his gas at three ounces pressure would receive 1,012 feet of gas as measured at atmospheric pressure, or 1,012 heat units, is that correct?

[fol. 279] A In that ratio, yes.

Q And the patron who received his gas at two ounce pressure would receive approximately 1,008.5 or 1,009 heat units?

A Correct.

Q And the patron who received his gas at one ounce would receive approximately 1004, or 1005 heat units?

A Correct.

Q. And the patron who received his gas at one half ounce would receive approximately 1002 to 1003 heat units, is that correct?

A. Correct.

Q. Doctor, what is the mean atmospheric pressure in this locality?

A. Right about 14.4 pounds. Dependent upon certain air conditions but that is the average.

Q. That depends somewhat upon the temperature of the atmosphere at the particular time the pressure is taken?

A. Yes sir.

Q. But the mean average pressure in this locality is 14.4 pounds per square inch?

A. That is correct.

Q. If you wanted to raise gas from—if you have gas in a container at atmospheric pressure, you mean by that the gas in the container has exactly the pressure that the atmosphere on the outside has?

A. Yes sir.

Q. In other words, 14.4 pounds?

A. Yes sir.

Q. If you wanted to raise that gas to one ounce pressure, you simply add such quantity of gas as would make the pressure in the container equal 14.4 pounds, plus 1 ounce, is that correct?

[fol. 280] A. You mean the atmospheric pressure, plus 1 ounce?

Q. Yes.

A. Yes sir.

Q. Then would the quantity of gas in that container as compared with the quantity in it at atmospheric pressure equal 14.4 pounds, plus 1 ounce, divided by 14.4 pounds?

A. That would be the ratio.

Q. And that same ratio would prevail at other pressures, would it?

A. Yes sir.

Q. For instance, if you wanted to raise the gas to four ounce pressure, after you have done so, it would be 14.4 pounds, plus four ounces?

A. Yes sir.

Q. Doctor, does a standard natural gas meter register more quickly, turn faster and register a larger amount of gas in a given time at high pressure than it does at a low pressure?

A. Under the same conditions of manipulation, yes. At high pressure it registers faster than at lower pressures, but no more passes the meter.

Q. That is, if the pressure is low, it takes longer to pass the same volume of gas through the meter than it does when the pressure is high?

A. Yes sir.

Q. But if the pressure is low, it only registers that which passes through?

A. Yes sir.

Q. And if a man pays his bill based on the meter reading he only pays for what he got?

A. If he pays on a meter reading he pays for the amount which

goes through the meter. On the same principle as water. The [fol. 281] higher the head the faster it flows, and the lower the head the slower it flows, in a given space of time, but the meter registers that which flows.

Mr. Richardson: Take the witness.

Commissioner Walker: I want to ask you a few questions about this gas in the line, what effect it has,—how dangerous it is?

A. You mean air in the line?

Commissioner Walker: Yes.

A. My opinion of air in the line,—I want to get just as far away from it as I can get when there is air in the line and I know it. A very small percentage of air in the line renders the gas dangerous, and above a certain amount, a certain amount of dilution with air, or oxygen, rather as it is not the air particularly, but the oxygen in the air, and when you mix a definite amount of oxygen with natural gas it acts just as badly as with hydrogen, because it is the hydrogen which is in the natural gas principally, that causes combustion, and there is more heat comes from the hydrogen than from the carbon that is in the gas, and when you get natural gas mixed with oxygen above a certain amount it becomes explosive, but until you get it to a point where it will explode, or nearly so, it will not burn. The oxygen lying there becomes a very dangerous thing.

Commissioner Walker: You don't think there is much to the idea of them pumping much air in a line with gas then?

A. Oh no. Whenever there is air in the line you can always find free oxygen. When you cannot find free oxygen in a gas you may know there has been no air gotten into it, as our air is merely a mixture of Nitrogen and Oxygen, and the Oxygen is not combined with [fol. 282] the Nitrogen and that leaves it free to combine with other gas. You can take ten centimeters of gas in what we call an explosion tube, and you can put in this requisite number of four or five volumes of free oxygen in it, and you can explode it with your spark passing through without much trouble, but you increase that above ten per cent in the combustion tube and you will always see the operator protect himself by placing something in front of him for fear the explosion of that oxygen will cause a breaking of that tube and throwing the pieces of glass at him. Quite often that happens. I have known, and been present, when operators have had pieces of glass hit them in the face. In an operation a Mr. Porter and I were conducting, a piece of explosion tube with 12½ centimeters of gas with the requisite amount of air, broke the tube and blew a piece of it through his ear. You are all acquainted with the fact of the explosion out here at this plant where Dunlap was repairing it. It blew a piece of that eight inch casing—I don't know just how far, but a long, long ways, and certainly you are all acquainted with the fact of the explosion at Ardmore which was the mixing of gas with the air on the outside and as it kept mixing and soaking in it caused that explosion of two and a half or three

million feet of gas. That was the cause of it. Air mixing with gas. This natural gas is merely the lighter gas and when mixed with air becomes absolutely dangerous. If a gas company is putting air in their lines I cannot see what for.

Commissioner Walker: I have been around compressor stations quite a bit and I know the warning that is always given to operators at those plants to be very careful in taking casing-head gas to be very careful of air getting in the line. I have been surprised to hear [fol. 283] of this evidence coming out about air in the line from the experience I have had around fields.

Mr Richardson: Your honor has not heard any evidence that there is air in the lines.

Commissioner Walker: I think there was, to the effect that it burned like air.

Mr Richardson: You have not heard any testimony about air in the lines of the Oklahoma Natural.

Commissioner Walker: That has been discussed here right along.

(The witness, Prof. De Barr:) There is nothing to air in gas lines. The operator would not put in air because he knows of the destruction of property if there should be an accident, if it is not eliminated by consumption or burning.

Commissioner Walker: Another question I would like to ask. During these periods of low-pressure gas everybody complains they are not getting any gas but their meter seems to run as fast or faster. Is there anything in that?

A. Nothing in it. Absolutely it won't measure unless the gas goes through it unless the meter needs particular repairs. There is nothing to a meter running any faster. Most of the meters will not run fast enough by not having proper connections.

Commissioner Russell: Is it possible to utilize this low pressure of one, two, or three ounce gas with fixtures that are adjusted to six or eight ounces?

A. I think two ounce gas can be used with safety with proper fixtures.

Commissioner Russell: Do you mean efficiently?

[fol. 284] A. As far as I am personally concerned I cannot go below two ounces. From personal knowledge, but I have known of a great many operations on two ounces, but I know we cannot do anything with the laboratory pressure at much less than two ounces and we blow it in our own laboratory on two ounces and we recommend a pressure that will not exceed two ounces. Why it would not be the same thing in a house below two ounces now. I cannot say from personal knowledge and experience, but when you do put a high pressure on with a blast lamp and blow, I know you don't get the result.

Commissioner Russell: Well it is not possible to take a heating appliance that is constructed to use six or eight ounce gas ordinarily, and you keep your valve about a half or two thirds closed with that high pressure, and when you get down to one or two ounce pressure

you open it wide open and pass more product through, or more gas through, and still not get the result that you could get with the valves partially closed at high pressure?

A. You don't pass more gas through, Mr. Commissioner, because you open the cock you don't push more gas through. Unless you have got a greater head to make the gas flow. You don't get the gas and you don't get the combustion if you don't have the proper amount of air mixed. The greatest trouble with most of them is when they open up they will get a certain peculiar sound that they take for the flowing of gas, which may be the whistling of air through the opening in your attachment, and it is just like water, you know if you have a tank filled with water up a hundred feet high and you open the tap you will get a heavy flow. Now if you bring that head down to two feet, the flow lessens. You can open the tap wide, but [fol. 285] you don't get as much flow as you did with the smaller opening and the tank way up there. Instead of shutting off your pressure under six ounces, you don't get six ounces at your fixture because you have six ounces outside the meter. You cut down on your valve to cut off the supply at the fixture where you are burning it, and you no longer have that six ounces pressure at you fixture. You know that in opening your water tap, and you throw your tap wide open when you are connected with a hot water heater in the morning it will pop and crack and pound, and you cut down on your tap and cut down the pressure. You cut it down to a fraction of the pressure by the cock itself.

Commissioner Russell: But as you draw it down it shoots the water further?

A. No, mine does not. I get a lighter tap. You throw it to a certain point and you get the full efficiency of your tap and if the velocity is determined it will shoot it further, but you can keep on turning it down and you can make it drip can't you?

Commissioner Russell: Oh yes, you could turn it off.

A. (continued:) You don't get the full pressure because when you turn the cock off you don't get the full pressure on the fixture, and in the same manner the cock lessens the pressure of six ounces pressure on your meter by turning the cock.

Mr. Richardson: That is illustrated, Doctor, is it not, by the fact if you wish to fill a glass of water under a faucet and you open the faucet wide open the pressure is so great that all the water in the glass or that goes into the glass is thrown immediately out, so you cannot fill it, and you have to partially close the cock to reduce the pressure in order the water may fill the glass without sloshing out, is not that true?

A. Yes, and the same is true of blowing one gas out of the tube ahead of another.

(Witness excused.)

Mr Richardson If the Commission pleases, I have here a series of questions propounded by Mr. W. D. Harrell, Acting United States District Attorney for the Northern District of Texas, who was conducting an investigation under the Food Control Act with respect to natural gas, which questions were propounded to Mr. Ed Connors, Natural Gas Engineer to the Supervisor of Public Utilities of the City of Dallas, and the answers given to those questions. I showed them to Mr. Fulton, and told him I wished to introduce certain of them, and he said he would offer no objection. With the Commission's permission, I wish to read the particular questions that bear on this case, and the answers thereto. The first question is—this is entitled "Department of Justice, Office of United States Attorney, Northern District of Texas, Dallas, Texas, January 9, 1920. Mr. Ed Connors, City Engineer, City Hall, Dallas, Texas: Dear sir: I understand that you, in your official capacity investigated certain features of the gas situation for the Utilities Commission of Dallas. There is a controversy at Wichita Falls between the citizens there and the gas company in which there are various and sundry charges made as to the gas condition. I desire certain information for the benefit of our agents and this office with reference to our investigation to determine whether or not there is any violation of the food control act. If you will kindly answer so that a man who is not an expert may understand the same, I will greatly appreciate it.

Question 1. Can it be shown conclusively from a scientific standpoint that air can be mixed with natural gas by a distributing company?

Answer. It is possible, by use of a compressor set, to put air, or [fol 287] any other gas, into a distributing system; it would, however, be utterly impracticable, as there could be no mixing in the main except perhaps at the immediate point of intake and any length of travel in the mains would result in segregation due to difference in specific gravities. The equipment necessary to put any material amount of air into a distributing system would be a very large piece of machinery whose existence would be easily ascertainable. It must be further understood that the introduction of air into a gas system would cause the otherwise non-combustible gas to become highly explosive and very dangerous. Furthermore, the practical result, aside from the danger mentioned would be to extinguish all the consumers equipment, should it be possible to light it at all.

The next question is

Question 2. What is the effect upon meter reading of low and high pressure gas?

Answer 2. A meter is an accurate measuring device that will consistently measure, provided it is properly regulated and adjusted, the number of cubic feet of gas passing through this meter, whether the pressure be high or low. The element of time would be the only element involved. It would take a cubic foot of gas at a lower

pressure a longer time to pass through the meter than a cubic foot of gas at a higher pressure, but the meter would register both quantities correctly. The variations in the quantity of gas delivered owing to the variation from a predetermined pressure will be taken up in the answer to question 14.

Now, then, question 14 is this:

Question 14. What is the effect of measuring natural gas through [fol. 288] the same meter at various pressures of from one to four ounces per square inch?

Q 14. What is the effect of measuring natural gas through gas meter will register a cubic foot accurately whether the pressure be high or low. There is, however, a variation in actual quantity of gas delivered when the pressure varies, owing to the fact that gas is perfectly elastic and that a given quantity of gas will vary in volume inversely as the pressure. The difference between four ounce gas and 1 ounce gas, is, however, very small, owing to the fact that the absolute pressure of four ounce gas is 14.65 pounds per square inch, while that of one ounce gas is 14.4625 pounds per square inch. Should a meter be regulated to register accurately on the basis of four ounces above atmospheric and all of the gas passed through the meter was actually at one ounce above atmosphere, the meter would show the registration of, say, 1000 cubic feet, which gas would be the equivalent to 987 cubic feet at four ounces. The difference in a gas bill showing one hundred thousand cubic feet monthly consumption would be a little over fifty cents high. Domestic meters, however, are regulated, as a rule, for a considerably less pressure than four ounces, so that the variation in dollars and cents would be considerably less than above indicated. This, I believe answers question No. 16 also.

Question 17. What would be your estimate of the difference in the volume of gas passing through the meter in an ordinary domestic cooking operation with gas at normal pressure, and the volume wasted in the effort to do the same cooking at low pressure. In other words, why are meter readings as high or higher during periods of comparatively low pressure gas?

[fol 289] Answer 17. As fixtures are usually adjusted, there will be a loss in efficiency owing to low pressure, but if a proper adjustment is made, that is, bringing the vessel close to the flame, low pressure gas is actually more efficient. Meter readings are high during low pressure owing to the fact that the low pressure itself is evidence of an extreme drain upon the supply.

Mr. Richardson: Those are the questions and answers that I desire to introduce.

Commissioner Walker: Very well, we will take a recess until tomorrow morning at ten o'clock.

(Thereupon the hearing adjourned until Wednesday, January 28th, at 10 o'clock A. M.)

[fol. 290] Wednesday, January 28th, 1920.

The Commission duly convened, pursuant to adjournment, all parties being present. Whereupon the further taking of testimony was resumed, and the following proceedings were had:

COLLOQUY BETWEEN COURT AND COUNSEL.

Mr. Richardson: If the Commission Pleases, in this Order to show cause, upon which this present hearing is had, in cause No. 3846, and which order is entitled "Findings of Fact and Order" it is recited on page three, thereof, that on January 5th, 1920, the Oklahoma Gas & Electric Company appeared before the Commission and submitted charts showing records of gas pressure at which gas was furnished in the City of Oklahoma City since October 20th, 1919, and asking the Commission to investigate and determine discounts on bills for gas furnished by said company in Oklahoma City, properly allowable during periods of low pressure as prescribed by the orders and journal entry herein above referred to. I am not sure that it would be, but it occurred to me that that might be misinterpreted, and might be interpreted to mean that the Company was consenting to the matter of rebating or discounting the bills and was requesting the Commission to order said rebates or discounts and to investigate, determine, and state the amount thereof. As I understand the facts are that the Commission had theretofore made the order referred to herein requiring rebates under the circumstances which have heretofore been shown, and requiring the Company to keep pressure guages at each regular station in the City and to submit those to the Commission, that the Oklahoma Gas and Electric Company, on the 5th of January, 1920 did submit those to the Commission in obedience to that order, in order that the Commission might examine them, and investigate and determine the discounts which would be due under any order the Commission might make, but that the Oklahoma Gas & Electric Company was [fol. 291] not consenting to the making of rebates, or the ordering of rebates, and was not requesting the Commission to order rebates. I also state that the facts are that there is a contractual relation existing between the Oklahoma Gas & Electric Company, and the Oklahoma Natural Gas Company, whereby the Oklahoma Gas & Electric Company distributes the gas in Oklahoma City, as the agent of the Oklahoma Natural Gas Company, and that its compensation for that service, so performed, as such agent, is a certain percentage of the proceeds received for the gas. In that written contract it is provided that the gas shall be and remain the property of the Oklahoma Natural Gas Company until it is delivered to the consumer, and if the Oklahoma Gas & Electric Company should not have the consent of the Oklahoma Natural Gas Company to make any rebate, or reduction, or discount, and it should be determined by a court that it was not necessary, proper, or lawful to do so under the circumstances, then the Oklahoma Gas & Electric Company would be liable to the Oklahoma Natural Gas Company for that portion of it which would belong to the Oklahoma Natural Gas Company,

and that the Oklahoma Gas & Electric Company has recognized, and stated to the Commission at all times that the question as to whether a rebate should be allowed or not was one between the Commission and the Oklahoma Natural Gas Company, and that it was leaving the matter to be determined between them, and that these charts were therefore submitted in obedience to the order of the Commission for such action as might be deemed proper upon the hearing which would be had with the Oklahoma Natural Gas Company as a party. Now I wanted to ask the Commission if I have correctly stated the matter?

[fol 292] Commissioner Walker. I think, Judge, that is the way the Commission has understood it all along. The Oklahoma Gas & Electric Company said that they wanted to find out what the Oklahoma Natural was going to do in regard to these rebates.

Commissioner Russell. That is exactly the situation. All the while they have said they stood ready to obey the order but that it depended on the action of the Oklahoma Natural. That they would be bound by the acts of the Oklahoma Natural.

Mr. Richardson. Yes sir, that is what I understand the facts to be.

W. H. Crutcher, being called as a witness on behalf of the respondent, Oklahoma Natural Gas Company, having been duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. State your name to the Commission?

A. W. H. Crutcher.

Q. You live in Oklahoma City, Mr. Crutcher?

A. I do.

Q. Do you hold any position with the Oklahoma Gas & Electric Company?

A. I am Superintendent of the Gas Distribution of the Company.

Q. As Superintendent of the gas distribution of the Oklahoma Gas & Electric Company, what are your duties?

A. I have the supervision of the distribution of the gas which we received from the Oklahoma Natural Gas Company, have charge of [fol 293] the construction of the mains, installation of the meters, and other matters which arise in the distribution of the natural gas.

Q. In other words, as I understand you, you have general supervision over the natural gas operations of the business of the Oklahoma Gas & Electric Company?

A. I do.

Q. Mr. Crutcher, have you had any gas drawn from the mains in Oklahoma City chemically analyzed at any time within the last three months?

A. We have a sample of gas, or rather two samples of gas analyzed. The samples were taken from the mains of the Oklahoma Gas & Electric Company, about the middle of November, 1919.

Q. This shortage of gas about which complaint is made, was in the months of November, and December, 1919?

A. It was.

Q. Who made the analysis?

A. Mr. D. B. Dow, the Chemist for the Bureau of Mines, at Bartlesville.

Q. He is the chemist for the Bureau of Mines?

A. He is.

Q. Will you state to the Commission what the chemical contents of the two samples of gas which he analyzed from the Oklahoma City mains, showed?

A. There were two samples, 1, and 2, drawn from the mains of the Oklahoma Gas & Electric Company at the Company's plant, at 20 West Noble. There was another sample taken at the regulator distributing station at Reno & Pennsylvania which gas was a sample of the gas coming from the fields to the South, from Cement and Walters.

[fol. 294] Mr. Fulton. How large were those samples, how much gas?

A. Each sample he took contained about 500 cubic centimeters.

Mr. Fulton. I don't understand that. How much in ordinary language?

A. That would be equivalent to about a pint.

Mr. Richardson. The gas that he took was the gas that is furnished by the Oklahoma Natural Gas Company?

A. The first two samples were gas that was being distributed to the consumers.

Q. The first was—where did that come from?

A. From the plant at 20 West Noble.

Q. Was that gas that came from the Oklahoma Natural Gas Company's pipe line to the South, or the East?

A. Both. A mixture of the two gases.

Q. What was the chemical analysis of that gas?

A. Sample Number one, contained

Methane	66.98 per cent
Ethane	17.97 " "
Carbon Dioxide	0.11 " "
Oxygen	0.00 " "
Residue	14.94 " "

Sample Number Two contained

Methane	69.50 per cent
Ethane	15.65 " "
Carbon Dioxide	0.12 " "
Oxygen	.38 " "
Residue	14.34 " "

The gas from Cement, which was sample number three, contained:

[fol 295] Methane	84.89	per cent
Ethane	9.30	" "
Carbon Dioxide	0.38	" "
Oxygen	0.13	" "
Residue	5.29	" "

Q This was the gas that is used in Oklahoma City?
A The first two samples was as distributed to consumers.
Q In Oklahoma City?
A Yes sir.
Q The first sample you say was taken from the Oklahoma Gas & Electric Company's mains, where?
A At 20 West Noble.
Q And that shows no oxygen at all?
A One sample shows none and one shows——
Q I am asking you about sample Number One?
A Yes sir.
Q It shows no oxygen at all?
A None.
Q And there being no oxygen, it shows there is no air, is that correct?
A That is correct.
Q And the other sample, Number 2, shows 38 100ths of one per cent oxygen?
A It does.
Q That indicated then that there was 38 100 of 1% of air in that gas, was that it?
A No, it would indicate—if that indicated the presence of air it would be a larger percentage than that as air is composed of one part of oxygen and 4 of nitrogen, so it would indicate five times that percentage of air.
Q That would be about one and a half per cent?
[fol 296] A 1 2 per cent air.
Q And the gas that was analyzed from the Cement field, that showed 13 100ths of one per cent oxygen?
A It does.
Q According to that then that would be about 65 100ths of one per cent of air, is that right?
A Yes sir.
Q Ask you whether or not the amount of Oxygen shown here is such as errors unavoidable errors in making tests might show even when there was in fact no oxygen there? In other words, is that within the variation of error?
A It is well within it.
Q Mr Crutcher, as Superintendent of the Gas Distribution of the Oklahoma Gas & Electric Company, have you had occasion to examine the service pipes, as well as the pipes in a good many of the homes in Oklahoma City?
A In a large number of them.

Q About what is the proper size service pipe, and by the service pipe I mean the pipe running from the main in the street into the basement of the house of the consumer. What is the proper size service pipe in order to render good service at normal pressure to a consumer who has from a four to a six room house?

A An inch and a quarter service would be the smallest that would render efficient service.

Q If a person has a furnace, either hot water, steam, or hot air furnace, would an inch and a quarter service pipe be large enough?

A It would not.

Q Then for a house having from four to six rooms, you assume [fol 207] that would be heated by stoves?

A Yes sir.

Q And an inch and a quarter should be the smallest that he ought to use?

A It would.

Q If a person is using a furnace, either hot air, hot water or steam, an inch and a quarter you say would be too small?

A Yes, it would be too small.

Q What size pipe would be the least he ought to have for that service?

A Assuming a house of ten rooms?

Q Say from six to ten?

A Say from six to ten rooms he should have not less than a two inch service.

Q And as the rooms to be heated, or the size of the house to be heated increases, the size of the service pipe which is necessary to heat it also increases, does it?

A It should.

Q Now Mr. Crutcher, in addition to having a proper service pipe running from the main into the basement of the house, what would you say about the necessity of having proper lateral pipes running from that service pipe to the various rooms or appliances in which the gas is to be burned?

A It is just as necessary to have them of proper size as it is to have the service pipe of proper size.

Q I will ask you to state what percentage of the homes in Oklahoma City, in your estimation, based upon your experience and your observation here as Superintendent of the Gas Division of the Oklahoma Gas & Electric Company, are properly piped, both with regard to the proper size service pipe and the proper sized laterals? [fol 208] A Of course I have not been in every house in Oklahoma City and necessarily it would be an estimate, but judging from the houses that I have examined, I feel safe in saying that there are not 25 per cent of the houses in Oklahoma City properly piped, considering the service pipes and the house pipes together.

Q I omitted to ask you how long you had been Gas Superintendent of the Oklahoma Gas & Electric Company?

A I have been with the Oklahoma Gas & Electric Company for two years.

Q Does the relative size of the service pipes and of the lateral

pipes have anything to do with the quantity of gas which the consumer can get and use within a given time?

A It has a very decided effect.

Q Now, even if the consumer's service pipe was large enough, if the laterals in his house leading from the service pipe to the different rooms or appliances were too small, would the service still be inefficient?

A It would be very necessarily impaired.

Q If the laterals were large enough and the service pipe too small, would the patrons' service still be inefficient?

A It would be impaired under those conditions.

Q Mr. Crutcher, you were present yesterday and the day before when Mr. Rogers made a statement in regard to the service in the three story apartment house in which he lives, were you not?

A I was.

Q After Mr. Rogers made that statement, did you make any examination of that house and the service pipe?

A I did.

Q I will ask you to state to the Commission what size house that [fol. 299] is?

A It is a three story apartment house, containing twelve apartments.

Q How many rooms to each apartment?

A They have an average of three rooms to each apartment.

Q Then that would make a 36 room house?

A 36 rooms, yes sir.

Q Now I want to ask you first, whether or not the apartment is filled, and there are twelve families living in that apartment house?

A Well I did not go through all the apartments, but the meters were turned on for twelve apartments.

Q All right, go ahead. Now you say that is a 36 room house and it has 12 meters for service there, and were there any other meters there?

A There was one other meter supplying a Rudd Water heater.

Q Then as I understand you, there were thirteen different meters in that house?

A That is right.

Q And thirteen different accounts?

A That is right.

Q State to this Commission what size service pipe runs from the main into that house to serve those thirteen different meters, with thirteen different accounts?

A An inch and a quarter service pipe.

Q And I believe you said that an inch and a quarter was the least that even a four or five room house ought to have?

A That is right.

Q State to the Commission whether an inch and a quarter service pipe is adequate to supply thirteen different consumers using gas from thirteen different meters, or even twelve meters?

[fol. 300] A It is not.

Q What would be the least size service pipe running from the

main in to the house that would be adequate to supply that many consumers and to heat a house of that size?

A I would consider a three inch pipe as the absolute minimum.

Q What is the relative gas delivering capacity of a three inch pipe as compared with an inch and a quarter?

A It would deliver about ten times the volume of gas that an inch and a quarter pipe would deliver.

Q In order words, in order to get the capacity we would take the radius, square it, and then multiply by 3.1416 would we not?

A The rule would be that the delivering capacity of the pipe runs as the square root of the fifth power of the diameter of the pipe.

Q That is one way. If we cut a cross-section of the pipe, however, it is a circle.

A Yes.

Q But the space contained in that circle, which shows the space through which gas can flow can always be determined by taking the radius, which is one half the diameter of the pipe, and square it, and multiply by 3.1416?

A Yes, that would give you the area.

Q And that area is the space through which gas can flow in that pipe is it not?

A Yes.

Q Now you say there was a thirteenth meter, connected to a Rudd water heater?

A There was.

Q What is a Rudd water heater, and how is it constructed?

[fol. 301] A It is a device for heating water automatically as it is called. It consists of the shell in which is copper coils with gas burners underneath those coils and a control valve so arranged that whenever the hot water faucet which is connected to this heater is turned on, the lessening of the water pressure will automatically open the gas valve.

Q When the valve is open the flame comes up and applies the heat to the coils and heats the water as it passes through?

A That is right.

Q When you cut off the water the gas valve closes leaving nothing burning but a pilot light and the consumption of gas stops excepting the small amount that the pilot light consumes?

A That is correct.

Q In order to get the gas to heat the water in that heater it is necessary that the flames be applied to the coils through which the water passes?

A That is right.

Q Was there any complaint of the fact that the hot water heater was not giving service. That the gas was not heating the water?

A At the time I was there, one of the tenants stated they were having very poor service from the hot water heater, and she was under the impression we were there to remedy that condition. She said it took fifteen to twenty minutes to get any hot water at all from the heater.

Q In other words, when she turned on the water and the water

began to flow it opened the gas valve but the gas did not heat the water?

A No.

Q Did you examine that Rudd Heater to see what its condition [fol. 302] was?

A I did.

Q State to the Commission what the condition of the heater was?

A I found the coils of the heater thickly encrusted with carbon, with long festoons of soot hanging from the coils. This carbon would act as a heat insulator to prevent the heat from the flame being transmitted to the water in the coils. The adjustment of the burners were very bad. There was a long white open flame from the burner.

Q What was necessary to remedy that situation so far as the heater was concerned?

A The burners themselves should be adjusted and cleaned out, but more important than anything else the coils should be cleaned, and the carbon and soot that was caked on there should be removed.

Q That carbon and soot is a non-conductor of heat is it not?

A It is.

Q If the coils were encased with that the reason it took so long to heat the water was the fact that the heat the gas generated could not be applied to the coils?

A That is it.

Q Was that the fault of the gas, or the fault of the conditions in which that heater was maintained?

A It was the fault of the condition of the heater.

Q Were you present the other day and saw the demonstration which Miss Ehfritz, of the United States Bureau of Mines made with respect to the efficient use of gas and the use of efficient and inefficient appliances in burning gas?

A I was.

[fol. 303] Q Does the Oklahoma Natural Gas Company maintain an efficiency department?

A Do you mean the Oklahoma Gas & Electric Company?

Q Yes?

A It does.

Q Here in Oklahoma City?

A Yes.

Q How long has it maintained such a department?

A For about a year and a half, I think.

Q Does it maintain appliances and instruments for demonstrating to the people the efficient use of gas, and what are and what are not proper and efficient appliances for the use of gas?

A It does.

Q I will ask you whether or not it has carried on any campaign of this matter and advertising to the people the fact that they maintain such a department?

A It has.

Q Are the services of that efficiency department free to the people?

A Absolutely free.

Q Have they been free ever since it was installed more than a year and a half ago?

A It has

Q Has the fact that the service of the efficiency department been free to the people also been advertised?

A It has

Q Did the Oklahoma Gas & Electric Company put on an efficiency demonstration something like Miss Elfritz had here the other day at the Chamber of Commerce in Oklahoma City?

A It did

[fol 304] Q Ask you whether or not they thoroughly advertised the fact they were making such demonstrations?

A We did

Q What was the object and purpose of that demonstration?

A It was for the purpose of calling the people's attention to the fact that much better service could be rendered by efficient appliances than could be rendered by inefficient appliances

Q And proper adjustments?

A Yes, and furthermore that those adjustments could be quickly and easily made

Q Was that for the purpose of showing how to make them?

A It was

Q And for the purpose of showing what were and what were not proper appliances?

A It was

Q You say that demonstration was advertised?

A It was

Q Was the demonstration held?

A It was

Q How many people attended?

A I think about 25

Q Did you also conduct that same thing in El Reno?

A We did

Q Did you also advertise it there?

A We did

Q How many people attended there?

A Two

Q You are still maintaining that efficiency department are you?

A We are

Q Who is at the head of it?

[fol 305] A Mr John T Naylon

Q And his services are, and have been, free to the public?

A Absolutely

Mr Richardson If the Commission pleases, there is a particular part of other testimony that I want to offer and as a preliminary to offering it, I want to get this clear There was some preliminary matters connected with this order which is not quite clear to my mind The order of the Commission upon which this hearing is being held for establishing certain discounts in certain portions of the city as I understand it, the portions of the city were fixed by the various

regulator stations at which pressure gauges were maintained and wherever the pressure in any particular district in which a pressure gauge was maintained, fell below four ounces, the Commission's order requires a discount of all bills in that district in proportion to the diminished pressure and in proportion to the duration of the diminished pressure?

Commissioner Walker: Correct.

Mr. Richardson: That order embraced all consumers in that district, as I understand it?

Commissioner Russell: All domestic consumers.

Mr. Richardson: Does the Commission consider the heating of a building, like an office building, as a domestic consumer. They are not industrial and they don't manufacture anything.

Commissioner Walker: That is a question, Judge, that I don't know whether we have ever passed on or not. They would be domestic consumers in a way.

Mr. Richardson: They have always so considered themselves, and still their service would be cut off before a home, and yet they are not like a factory or anything of that kind.

[fol 306] Commissioner Walker: They would be in a different class, all right.

Commissioner Russell: To the extent of warming a man's body they would be right smart domestic. He doesn't feel very domestic unless he is comfortable.

Mr. Richardson: I don't interpret this order as making any distinction between stores, banks, office buildings, apartment houses, stores and shops and things of that kind.

Commissioner Walker: I don't think the Commission has ever passed on the question of office buildings.

Mr. Richardson: It is a question of interpreting this order.

Commissioner Walker: Industrial gas, we have always considered that as gas used by factories or large users of gas where they used it for the purpose of firing boilers and things like that. I guess in these office buildings that is the way they use it.

Mr. Richardson: Yes sir, they burn it under boilers.

Commissioner Walker: Still it is used to keep people warm, while in the other places it is used for manufacturing.

Mr. Richardson: All right.

Q. Mr. Crutcher, I notice in this order of the Commission on which this hearing is being held, the Commission takes what it calls district No. 1, and that district is described in the order as that portion of the city, that is, Oklahoma City East of the Santa Fe railroad and north of the Rock Island railroad, and the meters they state are read, on the average on the 25th day of each month. Then they subdivide that district (b), or subdivision B. Now subdivision B is that portion of the above district west of High street. That is [fol 307] to say it is that portion of the city of Oklahoma City East of the Santa Fe Railroad, north of the Rock Island railroad and west of High street. That is, the boundary on the east is High street, on the West is the Santa Fe Railroad, the south by the Rock Island

railroad and by the north the city limits. Do you know, or are you able to estimate in general figures, the number of people residing in that district who, during the periods of low pressure, used coal or other fuel and did not use gas for heating purposes. Have you given any consideration of this, or made any notes of it, or anything of that kind?

A. It would be difficult to give more than an estimate, or express my opinion which estimate would be based upon the facts which I received from personal observation, reports of our inspectors and meter men as to conditions. It would not apply to every house in the district.

Q. I know it would not apply to every house.

A. Then before answering that question I would say that there is another basis on which to make the estimate. That during the summer of 1918 we made a survey or canvass of the entire city to find out how many of the people, what proportion of the consumers were equipped or prepared to burn other fuel than gas.

Q. Now could you also form any opinion, taking the basis of the complaints made as to the bills rendered, where the persons would say that their bills ought not to be so high because they were burning coal?

A. That would be one method by which an idea could be gotten of the conditions.

Q. There were such complaints from that district?

A. There were.

[fol 398] Q. Now from all of those facts, could you state to the Commission whether or not there were any persons residing in that district, who, during the periods of low pressure, used coal or other fuel and did not use gas?

A. The district you have referred to is bounded on the west by High street is it not?

Q. No, it is bounded on the West by the Santa Fe, and on the East by High street, on the South by the Rock Island, and runs to the city limits north.

A. That is what they designate in there as subdivision (a) of that district?

Q. No, it is subdivision (b).

A. I would say that somewhere between five and ten per cent of the gas used in that district during the month was used by people who, during periods of low pressure, used some other fuel than gas.

Q. This order requires all bills in that district for that month to be discounted fifteen per cent. If that were true, then some patrons' bills would be discounted who were not using gas during low pressure periods and the whole of whose bill was incurred in the use of gas when the pressure was normal, is that true?

A. There is no doubt of that.

Q. Take the subdivision (c) of that district, which is that portion of Oklahoma City east of the Santa Fe railroad, and east of High street, north of the Rock Island and bounded on the east and north by the city limits. That would include Culbertson's Heights and some other portions there would it not?

A. It would.

Q. What would you say as to the proportion of people in that [fol. 309] subdivision of the district who, during periods of low pressure used coal or other fuel and did not use gas?

A. There were a great many more houses built in that section before the natural gas mains were extended. Those people had used some other fuel prior to the introduction of natural gas, and I think it is a safe assumption that the percentage of people who used coal or other fuel aside from gas would be much higher than it would be in the first district we mentioned.

Q. Now those people who built there prior to the introduction of the gas lines there, you mean they had equipped themselves for other fuel?

A. Yes sir.

Q. And did they use gas in normal weather?

A. They did.

Q. But as I understand you, your statement is that the percentage of the gas consumed in this subdivision of the district, subdivision (c), that is the number of people who, during periods of low pressure gas used coal or other fuel and whose gas bill was incurred during normal pressure would run considerably higher than your estimate as to subdivision (b) where you said it was from five to ten per cent?

A. It would.

Q. The order of the Commission requires the discounting of all bills for gas between November 25th, and December 25, 1919, in this subdivision (c) of this first district, to be discounted 28 per cent. If that should be done, then those persons, and you say the number of them run considerably higher than from five to ten per cent, who used other fuel during low pressure and whose gas bills were incurred during times of normal pressure would still have their bills discounted 28 per cent just the same?

A. They would.

[fol. 310] Q. The Commission described another district in this order as being that portion of the city lying west of the Santa Fe railroad on the east,—that is, the Santa Fe railroad bounds it on the East, north of the alley between 2nd and 3rd streets, East of Pennsylvania avenue, and south of 7th street on the north. Now, let's get the boundaries fixed in our minds. Bounded on the East by the Santa Fe railroad, on the south by the alley between 2nd and 3rd streets, on the west by Pennsylvania avenue, and on the north by 7th street. Then, they take a subdivision of that, and they say that in that portion of this district East of Dewey avenue, in other words, the western boundary would be Dewey avenue, and the Eastern boundary the Santa Fe railroad, the southern boundary would be the alley between 2nd and 3rd streets and the northern boundary would be 7th street. That would include the Oklahoman building would it not?

A. It would.

Q. The publisher of the Daily Oklahoman?

A. Yes sir.

Q Which is a four or five story building?
A I think it is higher than that. Six stories I believe.
Q And that would also include the Pioneer Telephone building?
A Yes sir.
Q What height is that?
A Twelve stories, I think.
Q That would include all of Broadway from the alley between 2nd and 3rd streets to 7th street would it not?
A Yes sir.
Q That is wholly business, is it not?
A Yes sir.
[fol. 311] Q Stores, garages, automobile establishments, and things of that kind?
A Yes sir.
Q As well as the Pioneer Telephone building and the Daily Oklahoman?
A It is.
Q Everything from Santa Fe to Broadway in that district is also business is it not?
A It is.
Q And a goodly portion of it between Broadway and Robinson is also business is it not?
A It is.
Q What proportion would you say of the gas used in that district during the low pressure was used by persons, who, during those periods of low pressure, were burning coal, oil or some other fuel, and were not burning gas?
A During the periods of low pressure we have had men patrolling that district to see if the large consumers, some of whom you mentioned and some others that you failed to take in, were not using gas but were using some other fuel or coal, and I would say that of the gas used during the month in that district, at least fifty per cent of it was consumed by people who, during low pressure, used some other fuel than gas.
Q And whose bills were, therefore, incurred at normal pressure?
A They were.
Q Passing now to district four. That district is described in the Commission's proposed order as that portion of the city bounded on the east by the Santa Fe railroad from the alley between Second and Third streets to the Rock Island, and Byars avenue from the [fol. 312] Rock Island railroad to California avenue, on the South by California avenue, on the west by Pennsylvania avenue, and on the north by the alley between Second and third streets from Pennsylvania avenue to the Santa Fe railroad, and the Rock Island railroad from the Santa Fe railroad to Byars avenue. In other words, that district would be bounded on the north by the alley between second and third streets, on the East by the Santa Fe railroad, and it would be bounded on the south by California avenue, and on the West by Pennsylvania avenue. Now the Commission subdivides that district, and their subdivision (a) is that portion east of the

Santa Fe railroad—now that goes on across the Santa Fe to Byers don't it. Byres is East of the Santa Fe, is it not?

A. Yes sir.

Q So it says in that portion of the district East of the Santa Fe railroad. That then, would be that portion of the district bounded on the west by the Santa Fe, Byers avenue on the East, the alley between 2nd and 3rd streets on the north, and California avenue on the south. What is the nature of that district?

A. That is occupied mostly by the wholesale trade. Wholesale groceries, and businesses of like character.

Q There are wholesale groceries there?

A. There are.

Q Wholesale furniture stores?

A. There are.

Q Wholesale hardware stores.

A. Yes sir.

Q And wholesale Dry Goods stores?

A Yes sir.

Q Were they users of gas in normal weather?

A Yes.

[fol 313] Used it for heating purposes?

A For heating purposes, yes.

Q Did you patrol that district and require them to discontinue the use of gas in cold weather and require them to use coal or oil?

A. We did.

Q And did they do so?

A They did.

Q What per centage of the gas burned and used during that month in this district, in your estimation, was used by persons who, during the periods of low pressure were not using gas, but were using coal or oil or some other fuel and whose gas bill for the month was incurred when the pressure was four ounces or better?

A I will say that at least 95% of the gas used in that district was used under those conditions.

Q Now then in that same district, but subdivision (b) which is described as that portion of the district between the Santa Fe railroad and Robinson avenue. That is to say, that is the district bounded on the north by the alley between second and third streets, on the south by California avenue, on the East by the Santa Fe railroad, and on the west by Robinson street or avenue. What is the character of that district?

A. That district is almost entirely filled up with office buildings and hotels. Included in that would be the Skirvin Hotel.—

Q And would there not be stores?

A Yes, and stores. The Lee-Huskins Hotel, Lawrence Hotel, Kingkade hotel, American National Bank building, Baum building and a number of other large buildings.

Q The Lee Building?

[fol 314] A Yes, the Lee Building, the Insurance Building.—

Q The Y. M. C. A.

A Practically the entire district is covered with large establishments.

Q It is also covered with a great many stores, is it not?

A Oh yes,—and the Kerr Dry Goods Company,—no, they are not in that district——

Q No, they are west of Robinson, but it is mainly retail stores along there?

A Yes sir.

Q What percentage of gas consumed in the month in that district was consumed by persons who, during the period of low pressure used coal, oil, or other fuel, and were not using gas, and whose bills incurred for gas during the month were incurred when the pressure was normal, that is, when it was four ounces or better?

A As we patrolled that district constantly during low periods I feel safe in saying that at least 95% of the gas was consumed under these conditions.

Q How many times a day did you patrol it?

A Twice a day, and sometimes during the night.

Q Passing from that to subdivision (c) of this district which is described in the Commission's order as that portion of the district between Robinson avenue and Shartel avenue. That is to say, it is bounded on the East by Robinson, on the west by Shartel avenue, on the north by the alley between second and third streets and on the south by California avenue. That would include the whole of Grand avenue would it not?

A It would.

Q The whole of Main street, or the business part of Main street, and it would include the whole of the business part of Grand avenue?

A It would.

[fol. 315] Q The whole of the business part of Main?

A It would.

Q And the whole of the business part of first and second street?

A It would.

Q What is the character of consumers of gas there?

A In the east end of that district is composed almost entirely of large office buildings and mercantile establishments. Located in that are the Colcord Building, the State National Bank, the First State Bank building, the Terminal Building, the Mercantile building, Patterson Building, Majestic or Southwest Reserve Bank Building——

Q The Grain Exchange?

A Yes, the Grain Exchange, Kerr Dry Goods Company——

Q Scott-Halliburton?

A Yes, Scott-Halliburton——

Q Rorabaugh-Brown Dry Goods Co——

A Rorabaugh Brown,—it would be almost impossible to name them all and it would be a long list, but practically all of the east end of that district is occupied by large buildings.

Q And the rest of them are stores, are they not?

A Practically all of them.

Q Whether large or small?

A Yes sir.

Q Did you also patrol that district?

A We did.

Q What percentage would you say of the gas consumed in that district during the month was consumed by persons who, during the periods of low pressure, used coal, oil, or some other fuel for heating purposes and did not use gas, and whose bills for the month [fol. 316] were incurred at a time when the pressure was four ounces, or better?

A I should say at least ninety per cent.

Q Now passing to the fifth subdivision,—I mean to the fifth district, and subdivision (e). The fifth district is that portion of teh city lying south of California from Pennsylvania avenue on the west to Byers avenue on the east, and subdivision (e) thereof is that portion of said district lying east of Western avenue and south of the south boundary lines of the two above portions of the district named, which as I understand it is Capitol Hill, or West Capitol Hill?

A If it runs from Western to Byers it would contain both East and West Capitol Hill.

Q It says that portion East of Western avenue, and south of the south boundary lines of the above named portions of the district named. You say that would be the Capitol Hill District?

A Yes sir.

Q What do you know with respect to the conditions in the Capitol Hill district?

A The gas pipes were run into Capitol Hill some time after the majority of the houses had been constructed and the people there were using some other fuel than gas at the time gas was put in, so it is reasonable to suppose that a great many of the houses would be equipped and prepared to burn other fuel than gas. We have spent a great deal of time in that territory and a large number of our employees live there and I feel safe in saying that at least ninety per cent of the residences in that section are equipped to and do burn some other fuel than gas. That 90 per cent of the gas consumed in that territory was consumed by people who, during the period of low pressure were using some other fuel than gas.

Commissioner Walker. Does that condition apply to all of Capitol [fol. 317] Hill?

A All of Capitol Hill, yes sir.

Mr Richardson. You may take the witness.

Commissioner Russell. Before you pass this point I would like to ask a few questions on this line. You said in this district East of the Santa Fe you were asked about, first, that five or ten per cent of the people there are equipped to use, and you believe did use coal during periods of low pressure, either coal or some other fuel.

A Yes sir.

Q What percentage of the people in that district have paid their bills without protest?

A. I could not say that.

Q. Can you furnish them to the Commission. Do you know of anybody in that district who, during the periods of low pressure used coal or some other fuel than gas and who is now claiming a rebate?

A. As to their claiming a rebate I know absolutely nothing. I have nothing to do with the collection of the bills and have not the remotest idea of what percentage of bills have been paid or protested.

Q. Then you are not able to state, I take it, any party in any of these districts who was equipped to use and did use other fuel during low pressure periods and who has demanded a rebate on his gas bill?

A. As applying to the whole of these districts?

Q. Yes, do you know of anybody in any one of these districts who did not use gas during low pressure and yet has demanded a rebate?

A. At this particular instant I can answer by saying I do know of individual cases in practically all of those sections I have out-[fol. 318] lined that were prepared to and did use coal during the time of low pressure. As to whether they have demanded a rebate, I cannot say.

Q. Will you furnish to the commission as a part of the record, the percentage of the users in each of those districts that you outlined, who have claimed their rebate on account of low pressure, and the percentage of those who have paid their bills without protest?

A. I suppose it would be possible to give the figures. I expect I could get that from the Auditor's department. The Auditor's department should be able to tell how many or what percentage have paid their bills. But as to those that had claimed rebate, I don't see how they could arrive at that, unless they were to assume that failure to pay the bill during the discount period would be an indication of their intention to claim a rebate.

Commissioner Russell: I would assume they were holding back on account of rebates.

Commissioner Walker: Would not the fact that a number of people have asked you for a discount and a re-billing be an indication that they expected you to rebate them?

A. Yes, I expect there were quite a number of them.

Commissioner Walker: I think you can check back——

A. It would only be an estimate at best.

Commissioner Russell: Yes this is only an estimate.

A. I know, but when a party asks for a re-billing, and claiming a rebate, they would be told the matter was in the hands of the Corporation Commission and no rebate would be given until the Corporation Commission so ordered, and the party would go away and [fol. 319] either pay his bill as it was or hold it in abeyance.

Commissioner Russell: Will you furnish to the Commission the names of every consumer of gas on your lines who was equipped to use and did use, during the period of low pressure, other fuel than

gas and who used his gas at four ounces or more pressure, and who has asked for a rebate on low pressure?

Mr. Richardson. I think that is impossible.

Commissioner Russell. I think so myself, because I don't think there are any.

Mr. Richardson. Inasmuch as we are talking about rebates, it is their duty to show that they are entitled to rebate. It don't make a bit of difference if every man who had fuel during low pressure paid his bill without asking or demanding a rebate, so far as the legal effect of this order is concerned, he does it as a matter of grace to us, and not because of any obligation to do so. So the legality of this order would not be affected at all, not one particle, because a particular man happened to,—or any number of particular persons as a matter of justice between us and them, without any legal compulsion on their part, paid the full amount. The legality of this order is tested by its legal effect and not by what any particular person or class of persons did or did not do. Now it would be impossible to canvass this whole district to find out who had coal, particularly, in every instance, and who had oil, and who were not using gas during that particular period. This is a judicial proceeding. The person entitled to a rebate is the plaintiff. He is either the plaintiff actually, or the plaintiff in his behalf nominally, and if you are going to make an order to rebate them, you must say that [fol. 320] the person is entitled to it, and we are not required to show that he is not entitled to it. The burden is on him. For this order for rebates to be just and legal, even if it could be otherwise, it would be necessary to make it with reference to the condition that existed with reference to each particular consumer and you could not say that every person in a certain district where the pressure was a certain amount, without regard to what the facts as to that particular consumer were, would be entitled to the rebate. That is the order. He is entitled to it under this order as made, as a matter of law, whether he burned gas during that time or not, and if he elects to waive it, it is nothing but an act of grace on his part and is no legal obligation on his part and would not affect in any shape or form the legality of the order. That was my purpose in putting on this evidence.

Commissioner Russell. Well I think it is entirely in line with the broad scope that this hearing has taken and the range of evidence that has been submitted, it would be entirely proper that if there had been parties who are taking advantage of the order and demanding rebates when they did not use low pressure gas it should be brought out in evidence as showing the effect of what is claimed to be the injustice of the order, and in view of the fact these districts were patrolled twice a day the company certainly does have tab to a large extent on who used and who did not use gas as that was their purpose in patrolling the districts. If they do have a record, or knowledge that any person claiming a rebate did not as a matter of fact use gas during low pressure, it would be proper to introduce it in this case.

Mr. Richardson. It would cost us five times as much to get that

[fol. 321] information and make a showing as the rebates would amount to. We have patrolled the business part. We did not patrol the other. This is just an estimate of that. I say it must be determined by the legal effect of this order and it must be tested by its legal effect. I say that without proof at all that there is a single person that did do that, if it is possible that it could be done and that people could come up and claim and get the rebate who did not use gas during that time and whose bill was incurred under normal pressure, then that would render the order bad and we are not required and the burden cannot be cast upon us to go around and show and find out what every person burned.

Commissioner Russell: That has not been asked. But it has been asked that if you do have knowledge—not asking that you take your time to go out and hunt and investigate, but you say you have been patrolling that district, and in patrolling the district and collecting the bills if you have found any person who was not using gas during that period of low pressure and who is claiming a rebate that would strengthen your own testimony as showing that it was being done.

Mr. Richardson: The facts are that such persons as have paid their bills have all paid them as I understand, with the understanding that if the rebate is granted it is to be made to them just the same.

Commissioner Russell: The Commission's order has been invariably, if you had good service, pay your bill. If not, you are entitled to hold it up.

Commissioner Walker: Of course, that does leave that open. That was one of the things discussed when that order was put out. It does [fol. 322] leave it open for a man to claim a shortage of gas when in reality he may not have had much shortage.

Commissioner Russell: It would be interesting to know about that, and to what extent it is being done. But there are some other points I want to ask about. Now the consumer who has a large service pipe you say can get more gas than the one with a small service pipe?

A. Yes sir.

Q. Is it possible for any consumer, with the very best of appliances to obtain a larger pressure at his meter or at his service than obtains at the regulator station through which his gas comes?

A. Oh, no, that would be impossible.

Q. If any consumer shall increase the size of his service line he will secure more of the available gas, will he not?

A. Yes sir.

Q. And as any consumer ruptures his service, thereby he will automatically reduce the service of other consumers would he not?

A. Who are not as well equipped as he?

Q. Yes.

A. That does not necessarily follow, because if all the consumers in Oklahoma City would increase the size of the service they would draw out more gas through the main than they are doing now, but

if at the same time they would adjust their appliances to the point of highest efficiency there would not be the necessity of drawing any more or as much gas from the mains.

Q. Not if they all adjusted their appliances.

A. You must take the situation as a whole and not correct one feature of the situation and take no notice of the other.

[fol 323] Q. I believe the Commission will say,—I don't believe I would be misquoting any member of the Commission to say that we recognize that the correction of these appliances is very necessary and would be immensely helpful and would reduce the demand for gas, but I am discussing at this time the increase of the size of pipe so that our customer gets more. Your people have meters established through which runs all the gas that you bring within the city limits do they not?

A. Yes.

Q. Then if one should increase the amount which he draws, he decreases the amount that someone else could get?

A. Yes.

Q. You have answered the fact that no consumer could get any more pressure than the pressure at the regulator station?

A. Yes.

Q. Now I want to ask with reference to the Rogers flat, and the Kidd heater that has been so extensively discussed here as to be referred to by name. Will you furnish as a part of the record a copy of the bills for November and December for each of the thirteen meters in that flat?

A. All right.

Q. Also a copy of the bills for those same meters in November and December of last year.

A. All right.

Commissioner Russell. I think that is all I care to bring out.

Mr. Richardson. Do you know whether or not they burned gas at low pressure at that house last year because they could not get the proper pressure with their service line?

A. I have no personal knowledge of it.

[fol 324] Q. Last winter was a much warmer winter than this last year?

A. Yes sir.

Commissioner Russell. Have you any record of complaints from that house last year?

A. No sir.

Mr. Richardson. Has there been any complaint made by any tenant in that house this year?

A. No sir, we have had no complaint from any tenant in that house this year.

Q. This complaint of Mr. Rogers before the Commission is the first information you had?

A. Yes sir.

Commissioner Russell. None of this information asked for is conclusive on any one point, but they are merely straws that show how the stack is built.

Questions by Mr. Fulton:

Q. Speaking of that inch and a quarter pipe not being able to supply sufficient gas under a lower pressure than four or five ounces, it would supply sufficient gas if they would correct their appliances, would it not?

A. No, I hardly think it would Mr. Fulton. Not the demand at that house.

Q. I am not speaking about that particular house, but I say a house in general. What lead me to that question was this. You stated in substance, that if they put in the larger service pipe, that of course, would then draw gas from their neighbors who had possibly a smaller pipe, and then you said if they corrected their apparatus and one thing and another in the house they would not need so much gas. Then it came to my mind that if a person has a small service pipe they still might get enough gas under low pressure by adjusting their apparatus on the inside?

[fol. 325] A. It would improve their service considerably to adjust the appliances, but it would be only one-half of what was necessary.

Q. In all of these residence districts where the parties may have used other fuel to heat with, they still used gas to cook with didn't they?

A. Not in every case, no.

Q. What did they cook with?

A. I have heard of a number of cases where they used coal stoves for cooking.

Mr. Richardson. Some of them used oil stoves?

A. Yes sir.

Q. What would you say as to the proportion of those who used coal for heating purposes and also used some other fuel than gas for cooking purposes?

A. In regard to cases where some other fuel was substituted for gas it was for the purpose of cooking as well as heating.

Q. They were fixed up more for that in this district that lies East of the Santa Fe, you think that they were equipped to burn either coal or gas to cook with?

A. I think that quite a large number of them have either coal or oil or gas. Quite a large number of them.

Q. I know, but for cooking purposes exclusively, do you think they are equipped along that line to use any other fuel than gas?

A. You must remember this runs considerably further south.

Q. Well, in this district?

A. Yes, I think there are quite a large number of them.

Q. I have been in the city a good many years and I have never seen a coal range yet.

A. We made a canvass to determine that point and we found

that at least twenty per cent of the customers had provisions for heating or cooking with some other fuel than gas. That was made [fol. 326] in the summer of 1918, and since that time we have advertised, advising people to make some other arrangements for heating or cooking aside from gas. It is free to suppose that some people have done so.

Q. Let me ask you this question. In these districts, outside of the districts which you patrolled and where you based your estimate upon the persons who used fuel other than gas was that based upon any specific knowledge that they had used any other fuel than gas, or was that based upon the knowledge you had that they might have used other fuel?

A. In certain specific instances, to my knowledge there were certain people who were using other fuel than gas. All the figures I gave were necessarily estimates.

Q. That was what I was getting at.

A. And just by estimating, or reasoning or deducing we arrive at the fact that a certain number of people in the district did that.

Q. What if they did not have a coal or oil stove?

A. They would have been in a poor fix.

Q. But it is also based upon the understanding that you have at least that they did have arrangements whereby they could have used other fuel if they so desired it?

A. Not necessarily. That was just one of the factors that I took into consideration in arriving at that estimate.

Q. This efficiency man of yours, I want to ask you a question or two more about that. Does he make the corrections himself? He comes out and sees a patron's stove and sees the condition and says that these burners should be raised, and something else should be done here. Now will he do that himself?

A. If it does not require any large expenditure of time or material he will do that himself.

[fol. 327] Q. Otherwise you have to employ a plumber?

A. Yes, have to have a plumber to do so. However, he offers his services to supervise such changes and see that the plumber does it in a correct manner.

Q. Have you any particular burner that you recommend for furnaces?

A. No sir, we have not.

Mr. Fulton. That is all.

Commissioner Russell. I noted your testimony, if I understood it correctly, it was that a six to ten room residence should have a two inch service line coming in from the street?

A. Yes, provided the house had a furnace in it.

Q. Are you able to make an estimate of the percentage of that class of buildings that do have a two inch line?

A. In Oklahoma City, the number so fixed would be so small that the percentage would be negative.

Q. You said that a 36 to 40 room house a three inch pipe should be the minimum?

A Yes sir.

Q Can you make an estimate of the number of three inch service lines there are in the city?

A We have quite a number. I should say something in the neighborhood of 100 three inch services.

Q The Lee Huckins Hotel has one?

A The Lee-Huckins have a six inch line. Most of the three inch services are in the large buildings where boilers are being used. There are very few—I cannot recall any, but they are—oh very few indeed in the residence section, or apartments in the residence section of th city.

[fol. 328] By Mr Fulton: Another question. The size of the pipe is made necessary by the low pressure is it not. Or, if stated in another way, if you have a small pipe and a high pressure you would get the same amount of gas? Provided the pressure is maintained?

A Yes.

Q Then these large sized pipe you speak of would only be necessary to secure the gas at low pressure?

A Yes.

Mr Fulton: I think that is all.

Commissioner Russell: That is all.

(Witness excused.)

Thereupon the further hearing was continued and adjourned until 1 00 P M.

The Commission duly convened at 1 00 P M, the parties being present as at the time of adjournment, whereupon the taking of testimony was resumed, and the following proceedings were had:

[fol. 329] Mr J F Owens being called as a witness on behalf of the respondent, Oklahoma Natural Gas Company, having been duly sworn, testified as follows:

Direct examination.

By Mr Richardson:

Q Your name is J F Owens?

A Yes.

Q You live in Oklahoma City?

A Yes.

Q What relation if any, do you sustain to the Oklahoma Gas & Electric Company?

A Vice President and General Manager.

Q How long have you occupied that position in Oklahoma City?

A Nearly two years. Two years the first of March.

Q In order to shorten your testimony, with the permission of the Commission, I will ask you leading questions. The Oklahoma Gas

& Electric Company furnish gas in Oklahoma City as the agent of the Oklahoma Natural Gas Company, does it not?

A. Correct.

Q. It furnishes that gas as such agent under a written contract which declares that it is the agent of the Oklahoma Natural Gas Company?

A. Correct.

Q. And that the gas is the property of the Oklahoma Natural Gas Company until it is delivered to the consumer?

A. Correct.

Mr. Fulton: I don't know whether it is material to this litigation except I would not want to be admitting as a matter of fact that it was an agent. I don't know whether that is material.

Commissioner Walker: That is one of the things we took into [fol. 330] consideration in fixing the rate. That is a matter of knowledge to the Commission.

Mr. Richardson: The very same contract has been held by the Supreme Court to create an agency, and held by this Commission to create an agency, and held by everybody in this state to create an agency.

Mr. Fulton: All right.

Q. Now the Oklahoma Gas and Electric Company cannot furnish or distribute any gas in Oklahoma City except such as it can get from the Oklahoma Natural Gas Company, is that true?

A. Correct.

Q. It has no wells of its own, no gas field, and no pipe line to get gas with?

A. It has not.

Q. And there is no other company anywhere near Oklahoma City that could furnish gas direct except the Oklahoma Natural Gas Company?

A. None that I know of.

Q. Mr. Owen, do you know of any statutory provision in Oklahoma, or of any order of the Corporation Commission, or of any Ordinance of the City of Oklahoma City that makes it the duty of either the Oklahoma Gas & Electric Company, or the Oklahoma Natural Gas Company to furnish or install the gas consumer's service pipe from the curb into his house?

A. I know of none.

Q. There is none, is there?

A. There is none that I know of.

Q. It is the duty of the consumer himself to put in his own service pipe into his house?

A. It is.

Q. Is it also the duty of the consumer to put in the laterals from [fol. 331] the service pipe in his house to pipe the gas to the various rooms?

A. It is.

Q. Is it also the duty of the consumer or patron to buy his own stoves and furnaces and appliances for burning the gas?

A. It is.

Q. Is it also the duty of the customer or patron to clean and adjust those appliances, or have that done?

A. If they are adjusted or cleaned it is his duty.

Q. Do you know if there is any legal provision then, either in the form of a statute, ordinance of the city, or Order of the Commission that casts that duty as a legal obligation upon the part of either of the gas companies?

A. There is none.

Q. There has been more or less of gas shortage so-called for the past several years, has there not, in periods of extreme cold weather?

A. There has.

Q. Last winter—and by that I mean the winter in the latter part of 1918 and the early part of 1919, it was not so severe as this winter was it?

A. It was not.

Q. But the winter prior to that was rather severe and the shortage severe for a short time was it not?

A. It was.

Q. Has the gas company any legal right to prescribe the size or kind of service pipe that a customer must put in, or the kind or character or nature of the furnace, stove, heater, range, or burner that he shall use?

A. I believe not.

Q. It has no means to coerce him in that respect?

[fol. 332] A. Note: I might state by qualifying that statement somewhat, that it has the right to make reasonable rules and regulations governing the service, but it is very doubtful whether that could be extended to include the size of the pipe or the character of the appliances that might be installed in the home.

Q. Because that would relate more to the amount of gas that the consumer would get and if he was satisfied with that he would be the judge as to that?

A. Yes.

Q. Does the Oklahoma Gas & Electric Company maintain an efficiency department?

A. It does.

Q. How long has that been done?

A. It has been maintained for nearly, or approximately, a year and a half.

Q. Will you just give the Commission a history of that efficiency department, when it was installed, what your idea was and what was done under it?

A. A somewhat careful inspection of consumers' appliances, the reports of trouble men who were called to adjust troubles incident to the consumption of gas and the condition in which those appliances were found, the very wasteful waste of gas by the faulty adjustment of appliances and the use of the gas to which it was intended, demonstrated to us that the consumers could and should, by a proper knowledge of gas consumption, a proper knowledge of the appliances and regulation of the appliances, and a proper knowledge of

the appliances necessary to a proper regulation of those appliances when they were once installed, save a great portion of the gas which he would consume. Our investigation invariably revealed that wher- [fol. 333] ever there was an excessive consumption of gas and wherever there was a complaint of a high bill coming in and there was any justification for the complaint, that it was invariably due to faulty appliances, and careless or inefficient use of the gas. We then determined that a department to give the consumer knowledge would be effective in two ways. First, it would reduce the number of complaints of high bills, and would of course, as a result increase the good will of the consumer towards the company, and Secondly, it would tend in a large measure to the conservation of gas, which we saw, even a year and a half ago was seen to be a matter of scarcity. We had considerable difficulty in securing the right man. After careful search we secured the services of Mr. Mugg, who at that time was employed by the San Diego Gas Company, at San Diego, California. We brought him here and advertised the fact that we had brought him here as an efficiency man, whose duty it was to go into the homes whenever requested and inspect the appliances, and to adjust them and make such suggestions as might be necessary looking toward a more economical, more efficient, and more careful use of gas. His service was planned very largely to be educational, realizing of course that one man, or several men could not give individual service to every consumer. He secured very good co-operation from the Department of Economics at the High School, and gave several lectures there.

Q Did he also give demonstrations there?

A Also gave demonstrations, yes.

Q By demonstrations, you mean such demonstrations as were made by Miss Elfritz?

A Yes, only the demonstrations were considerably more elaborate [fol. 334] than we gave down here. If you like, I might cite an example of the character of the demonstrations he made. The meter we used in measuring the gas down-stairs in the dining room was our meter.

Q That is in the demonstration by Miss Elfritz of the Bureau of Mines?

A It was. And an ordinary hot plate was purchased. This was a portable hot place and the occasion for that was so it could be transferred from place to place easily. The burner of that hot plate was arranged so it could be raised or lowered at will. A container was secured containing five pounds of water. The burner on the hot plate was put at the position in which it is ordinarily found in the average range at home, and the number of cubic feet of gas which it would take, or which it did take to raise that five pounds of water from 70 degrees Fahrenheit was measured very carefully. Then the burner was put in the position,—or first, this was taken at the average pressure at which the consumer used his gas, say six ounces. Then the burner was raised and the pressure was cut to two ounces or thereabouts, with the burners raised to a position where the apex of the flame came in contact with the vessel and

the given time to raise the same quantity of water the same number of degrees was measured. Of course the water was changed. The time necessary and the amount of gas used was measured very carefully. That demonstrated fully and efficiently the saving that could be made by the proper use of gas.

Q. Did it take less gas at two ounces?

A. Very considerably less.

Q. That is a description of one of the demonstrations made?

A. Yes, other demonstrations were made in the actual installa- [fol. 335] tion in my home. I had my furnace equipped with a burner that would burn gas economically and efficiently at two ounces, and had my appliances adjusted to a two ounce pressure, and had installed under Mr. Crutcher's direction and Mr. Muggs supervision, an individual house regulator that permitted the use of gas only at two ounces pressure.

Q. So that it did not make any difference what the pressure was in the line or in the mains, it would not come in to your house at more than two ounces pressure?

A. Not more than two ounces, no sir. I demonstrated to my satisfaction that not only was the service more efficient, and not only was it very much more convenient in that once the appliances were adjusted no further adjustments need be made because the pressure was always uniform even in cases of low pressure, as there is hardly ever a time in the majority of low pressure conditions that it falls below that in the mains—I say hardly ever a time, there are times of course when the pressure was below two ounces, but in the main the pressure very rarely gets below two ounces——

Q. Below two ounces, you say, and yet had a sufficient quantity of gas to burn because you were efficiently and correctly using it?

A. Yes that advantage, and it had this further effect. This, as I remember, was installed in the early part of December. My bill for November, a considerably milder month was $21.00 for the entire gas consumed. After the installation of this equipment the following month my bill was only $13.00, which showed a very marked saving.

Q. What was the relative nature of the weather in these two months?

A. In the following month, somewhat colder.

[fol. 336] Q. In the following month?

A. In the following month, as I recall it. It was a test as to the efficiency of gas at these pressures when utilized in proper appliances, with proper mixture of air and proper burners. I might add, this equipment also included an automatic thermostatic arrangement whereby the gas was automatically controlled at the furnace so that an even temperature in the house was maintained. This thermostatic arrangement was operated electrically.

Q. So that the two ounce pressure in your home was not confined merely to cooking, but also to heating?

A. Yes sir.

Q. Used it in a hot air furnace?

A. Yes sir.

Q. Did you keep warm and comfortable?

A. Very comfortable.

Q. In December weather?

A. Yes sir.

Q. Was that December, 1919?

A. That was December, 1918.

Q. Have you had that same arrangement in that house ever since?

A. No sir, I sold the house in the spring of this year.

Q. You have not got that in the house where you live now?

A. No, I am living in a rented house and have been burning coal all winter.

Q. Mr. Mugg made those demonstrations in the department of Home Economics in the High School in Oklahoma City?

A. Yes sir.

Q. Were those advertised and people other than students of the High School requested to attend?

[fol. 337] A. I don't know that those particular demonstrations were. Those were not given generally.

Q. In addition to that, did Mr. Mugg make any other demonstrations?

A. Yes. May I, in answering that question state that Mr. Mugg's plan of campaign was to attempt to educate gas fitters, architects and others interested in the construction of homes, plumbers, and those who might be called upon to inspect appliances, and stove dealers and those who handled any sort of gas burning equipment, in an attempt, after individually, talking to each of those people individually, in an attempt to create interest in the matter of gas conservation and efficient consumption, and a mass meeting was called at the Chamber of Commerce, and particularly advertised, and it was very poorly attended.

Q. Was it advertised that he would make a demonstration there too?

A. Yes.

Q. Such as Miss Elfritz of the Bureau of Mines made?

A. Yes.

Q. Did he make that demonstration?

A. He did.

Q. How many people did attend, do you know?

A. Possibly 25, certainly not more than 30.

Q. Out of all of Oklahoma City?

A. Yes.

Q. A city of 100,000 people?

A. Yes.

Q. I understand he also advertised a demonstration of that kind at El Reno?

A. No, he did not do that. That was Mr. Naylon.

[fol. 338] Q. Do you know how many people attended that?

A. Mr. Naylon reported to me, only two. And, may I add, that was after not only an advertisement of it, but after urgent solicitation on the part of our manager there in an attempt to secure attendance.

Q Were those demonstrations free to the public?
A Yes
Q Were they so advertised?
A Yes
Q Was it advertised that the services of your gas efficiency engineer were free to the people to give them any information in regard to the use, and efficient use of gas and adjustment of their appliances, and things of that kind?
A Yes
Q Was it advertised that their advice was free in regard to the kind and nature and character of the appliances to buy?
A Yes
Q Now have you maintained that efficiency department up to the present time?
A Yes
Q Who is your present efficiency man?
A Mr. John T. Naylon
Q You still maintain that department for that same purpose?
A Yes
Q Do you still advertise the fact that his services are free to the public?
A Yes
Q Do you find that the public takes very much interest in the matter?
A They are taking somewhat of an increasing interest. They have taken quite a considerably greater interest since the gas shortage
[fol 339] Q The situation is about this, is it not. That as long as they can get plenty of gas at higher pressure without any regard to conservation or efficient use of it, the psychology of the human mind is such that they don't care about education along that line, is it not?
A That is generally true
Q They don't pay any attention to it until necessity drives them to it?
A That is generally true
Q Have you got any of the advertisements here that you run?
A Yes sir, this is the first one we ran, announcing Mr. Mugg's appointment. That was taken from the Live Stock News. That was run not only in the Live Stock News, but the Daily Oklahoma, the Times, and the Oklahoma News, and as I remember it, in the Capitol Hill paper also

Mr Richardson We ask to have this marked as respondent's exhibit 1

A (Continued) May I add something there?

Mr Richardson In just a minute. We now offer in evidence respondent's exhibit 1

(There being no objection, the same was received in evidence, and is in words and figures as follows, to-wit

[fol 340] RESPONDENT'S EXHIBIT 1

"It will be of interest to gas consumers to know that we have added to our force F. H. Mugg, formerly of San Diego, California, in the capacity of gas efficiency expert.

Mr. Mugg will be available without charge to our consumers and is prepared to give advice and counsel as to new installations and improvements in existing installations. He will co-operate with Mr. W. H. Crutcher, our gas superintendent. His services will be available in the order in which the application is received.

Investigation has demonstrated the fact that many gas installations are uneconomical and inefficient and that the consumption of gas may be materially reduced with even better heating results. The employment of Mr. Mugg is in line with our policy of doing our utmost to render the full measure of service which our patrons have a right to expect.

Oklahoma Gas & Electric Co. J. F. Owens, Vice-President and General Manager."

Q. Now you said there was something you wanted to add?

A. Along in the course of this educational campaign, which we attempted to carry on, we found that we must begin at the root and begin with the dealers, and we attempted to induce the dealers to procure, secure and offer for sale higher class apparatus, higher class stoves and equipment, and we found it necessary that we have installed a laboratory that was equipped to test almost any kind of gas burning appliance. We did install such laboratory at quite considerable expense, and we advertised that fact under date of April 10th 1919. This is taken from the Oklahoma News.

Q. Do you wish to keep this?

A. No, it may go in the record.

[fol 341] Mr. Richardson: We offer in evidence this advertisement marked for identification as respondent's exhibit 2.

(There being no objection, the same was received in evidence, and is in words and figures as follows, to-wit:)

"Gas consumers:

Our efficiency department is now thoroughly equipped with all the necessary apparatus to make investigations and tests as to efficiency of not only Domestic but Industrial gas burning appliances. We are glad to give this service without cost to you. Phone PBX-14 your gas troubles or needs and our Efficiency man will be glad to call on you.

Get ready now for next winter.

Oklahoma Gas & Electric Co. J. F. Owens, Vice-Pres. and Gen. Mgr."

Q. Have you any others there?

A. I have an editorial comment that appeared in the Oklahoma Times under date of May 10th, I believe it was, on the saving of natural gas, commenting on Mr. Mugg's work.

Mr. Richardson: We ask the stenographer to make this as respondent's exhibit 3 for the purpose of identification and we now offer the same in evidence.

(There being no objection, the same was received in evidence and is in words and figures as follows, to-wit:

"Saving Natural Gas

That is it possible to effect a saving of 50 per cent in the use of natural gas here is the optimistic opinion of F. H. Mugg, efficiency engineer of the local distributing company. That is important, if true, both as an economic and conservation measure. Natural gas is one of the greatest blessings any community can have. A [fol. 342] most convenient and satisfactory fuel (when obtainable) it is the history of the gas fields that it has been subject to prodigious waste, particularly by consumers near the wells who could procure it for a nominal price. Higher prices and frequent shortages have discouraged such prodigacy in communities more remote from the fields, but if willful waste has been eliminated there is no doubt that it is still consumed extravagantly for lack of proper knowledge of how to use it to best advantage.

It is that angle of the waste Mr. Mugg seeks to correct in Oklahoma City, and his talk on the subject to the gas appliance men tonight should be of interest to every gas consumer. Gas bills are high enough at present, like all other bills, and any opportunity to make a saving is like finding money when money is greatly needed. It is no secret that the gas company is seeking an increased rate, and may secure it ultimately. That prospect makes this opportunity the more important, for then the saving of gas will mean more in dollars and cents and be more of a necessity than it is today.

Nor should we forget that the gas supply is not everlasting. Those who have enjoyed it for years should be anxious to conserve it as much as possible for the rising generation. This efficiency expert says the greatest saving is possible by domestic consumers, although reduction in the amount used by industries is also feasible. Therefore both should profit by his suggestion. And half of the gas bill of this city would be a tremendous profit. Of course no such saving will be made, but by giving his saving methods the widest publicity, many will be influenced to use them, and a real service rendered to the community."

[fol. 343] Q. Now you say this was published in a local paper here?

A. It was published in the Oklahoman and Times and the reference to the Gas Appliance men is the demonstration about which we spoke a while ago, that we had also given publicity.

Q. Now you have carried this Efficiency Department down to the present day?

A. Yes sir.

Q. Do you still maintain your laboratory equipment for tests?

A. Yes sir.

Q Do you still maintain those appliances and keep them set up in your plant for the purpose of demonstrating to consumers the proper, correct and efficient way to use natural gas?

A Yes sir.

Q Those services are still free?

A Yes sir.

Q And the public is given to understand that?

A Yes sir.

Q Now did I understand you to state a moment ago that during the summer you sent out a warning to the people to lay up a supply of coal or other fuel?

A Yes sir.

Q In what way did you do that?

A I sent a special letter to each consumer in a specially marked envelope, with the word "Important" in red ink on the outside so it would not be treated as the average letter which might be thrown away and not read. In addition to that particularly on the gas bills, in the space on the gas bills reserved for announcements and advertisements we called attention to the proposition and called attention in interviews which were published in the press, but more particularly in this general letter a copy of which I have here.

[fol 344] Q Is this a copy of the letter that you sent to each consumer?

A It is. It was sent to each consumer.

Q And this was sent out when?

A Early in August.

Q What year?

A 1919.

Mr Richardson. We ask the stenographer to mark this as Respondent's exhibit 4, for identification, and we now offer the same in evidence.

(There being no objection, the same was received in evidence, and is in words and figures as follows, to-wit:)

"Oklahoma Gas and Electric Company

H. N. Byllesby & Company, Engineers and Managers, Chicago

Address all correspondence to the Company.

Oklahoma City.

To our gas customers:

We feel that it is a part of our obligation as a public servant to call your attention to the desirability of laying in a supply of coal as a reserve to be used against a possible emergency due to the interruption of the supply of natural gas next winter.

You will recall that last year we gave similar advice to our customers. We realize that it is our duty to keep in touch with the company supplying natural gas—the Oklahoma Natural Gas Company—

and we are informed that the prospect for an adequate supply during the coming winter is excellent. At the same time, long experience in the natural gas business has convinced us of the necessity of our customers having always on hand a reserve supply of fuel to protect themselves in case of emergency. During periods of exceedingly [fol 345] cold weather the supplying of natural gas is a difficult proposition, even under the best of circumstances. Lines sometimes break, and these breaks naturally happen when the transmission systems are being taxed to their capacity.

Even though the outlook for an adequate gas supply is reassuring, we respectfully urge you not to take chances but to be fully protected against emergencies. The health and comfort of yourself and family entitle this latter to earnest consideration. The time to buy coal is now when it can be obtained.

We wish at this time to call your particular attention to our new Gas Efficiency Department, which has been organized for the use of our customers and offered to you without charge with the view of promoting economies.

We desire that you obtain the utmost for the money which you spend for gas service. This department renders valuable service in connection with the application and use of natural gas entirely without charge.

We shall be glad to cooperate with you at your request.

Very sincerely yours, J. F. Owens, Vice-President & General Manager."

Q. Mr. Owen, do you know what percentage of your customers houses in Oklahoma City are properly piped, both with respect to the service pipe into the house and also the laterals to the various rooms?

A. Not of my own knowledge. Any answer I might give to that question would be from information that I have obtained, not particularly in Oklahoma City, but from general knowledge of the gas business.

Q. So you are not prepared to give anything more than a guess or estimate on that?

[fol 346] A. That is all.

Q. Ask you to state what is the proper size of pipe for houses of different sizes, and by "pipe" as I use it now, I mean the service pipe going from the main into the house?

A. The ordinarily accepted size for houses ranging from four to six rooms, where the appliances are gas stoves only, is an inch and a quarter. I have my own views on that, however.

Q. Does that depend on the size of the house?

A. I said from four to six rooms. That is the minimum size that good gas practice will allow anywhere, and personally, I think it should be an inch and a half.

Mr. Fulton. Does that depend on the pressure?

A. No, it does not. The pressure in the mains very rarely is more than six ounces. There is a fairly easy way of determining the de-

mand that a given house may make in times of maximum demand. Assuming, we will say, that a house in time of maximum demand needs 300 feet an hour with ordinary stoves, and that is possible, and I think probable in severe weather. The effect of that demand, regardless of what the pressure is in the main, is that in the appliances if your service is only an inch and a quarter, and the inch and a quarter pipe is, say six feet long, it will deliver only 250 feet of gas at a normal drop in pressure, say one inch water pressure, and the result is a decrease in the pressure at the appliance no matter what the pressure is in the main, so the larger pipe is a necessity even where the pressure in the main is normal. In other words, many, many houses are so piped that no matter what pressure may be carried in the main, that is reasonable pressure, or what would be considered normal, they could not get normal pressure at the ap- [fol. 347] pliance, and that is where they need it.

Q. Now then, Mr. Owen, with that explanation, you may proceed with your statement as to the size, passing from houses of from four to six rooms, and take a house from 6 to ten rooms, what is the minimum size of pipe to be used there?

A. Certainly not less than two inches.

Q. That is particularly true if the house has a furnace?

A. Regardless of whether it has a furnace or not.

Q. What would you say of a three story house, with 36 to 40 rooms, with thirteen meters, or accounts, what size pipe ought that to have?

A. Certainly not less than three inch. My practice has been in charge of construction work where there was a doubt of any character, to resolve it in favor of the larger pipe.

Q. Do you know what the consumption in Oklahoma City was in November, 1919?

A. You mean the daily consumption?

Q. Yes.

A. About thirty million feet as I recall it.

Q. Was that the maximum daily consumption?

A. Yes sir.

Q. In 1919?

A. Oh, I thought you said 1918.

Q. You mean the thirty million feet was in November 1918?

A. Yes sir. It ranged from sixteen million in 1919.

Q. When it run to thirty million feet in 1918 you had Industrial consumers on?

A. There may have been a part of the time.

Q. And in 1919, when you had from sixteen to seventeen million, you had them all cut off?

A. Yes sir.

Q. Do you know what the consumption was in December, 1919? [fol. 348] A. About the same as November. About the same or a little less.

Q. How many customers, or meters have you in Oklahoma City?

A. Something over 16,400.

Q. You heard the testimony of Dr. Crutcher in regard to the percentage of gas consumed in the various portions of these districts required to be related, in which the consumer used coal, oil, wood, or other fuel during the *low* pressure periods did you?

A. Yes sir.

Q. Have you any information in regard to whether or not the customers in those particular districts did use coal, oil, wood or other fuel instead of gas during the periods of low pressure?

A. Only such as came from reports which were transmitted to me through Mr. Crutcher from the patrolmen.

Q. From persons patrolling them?

A. Yes.

Q. In individual cases I presume you would have personal knowledge?

A. I never made any personal investigation myself. I had information of course, of individual cases which came to me through Mr. Crutcher in some cases, and in other cases from building owners, that they were not allowed to burn gas.

Q. Then from complaints made by owners stating that they were not allowed to burn gas you had some knowledge, did you?

A. Yes.

Q. From the information you received as Vice President and General Manager in regard to the consumption of gas in those districts during periods of low pressure, would you say that the estimates made and given by Mr. Crutcher were, or were not, approximately correct? [fol. 349] A. I should imagine they are probably approximately correct. They would be only estimates, of course.

Q. Well an estimate is all it could be under the circumstances is it not?

A. Yes sir.

Q. The Oklahoma Gas & Electric Company operates in Oklahoma City under Ordinance No. 11159, does it not?

A. Yes sir.

Q. Being the franchise.

A. Yes sir.

Mr. Richardson. I have here a copy of the ordinance made by Mr. Johnson, of the Corporation Commission. This ordinance was required to be filed with the Commission.

Commissioner Walker. What is that?

Mr. Fulton. The City Ordinance. I think if any of it goes in that it should all go in.

Mr. Richardson. This copy was made for another purpose, and I didn't care to offer it all.

Mr. Fulton. If it is correct that is all right.

Mr. Richardson. I just want to dictate this part in the record. It is on file with the Commission. He made this copy for me for another purpose and all I want to do is to introduce a part of this.

Commissioner Russell. It can be introduced in the record.

Mr. Richardson. I want to introduce section 3.

"Sec. 3. During the life of this franchise, said grantee shall have the right to charge said city and the inhabitants thereof not to exceed thirty five cents per thousand cubic feet for natural gas furnished, provided, however, that said grantee in all cases where the consumer's bill is less than one dollar per month, may charge a minimum rate of one dollar per month for each service connected."

Mr. Fulton. That minimum charge has been abolished by the [fol. 350] legislature has it not?

Mr. Owen. Yes sir.

Mr. Richardson. There is nothing in this franchise that provides the rate shall be according to pressure is there?

Mr. Owen. No sir.

Commissioner Walker. The 35 cents was abolished by the Commission was it not?

Mr. Richardson. Yes sir. The only point I was getting at, is that there is no ordinance of the city, or law of the state, until this proposed order of the Commission, that made pressure enter into the rate. There is not even a provision in this franchise that says they shall furnish an adequate supply.

Mr. Fulton. The Gas Company didn't question the jurisdiction of the Commission to abolish the 35 cent rate did it?

Mr. Richardson. No, and I am not introducing it for that purpose. Any court would take judicial knowledge of a statute, if there was a statute of the state on the question, but they would not take judicial knowledge of the ordinances of the city if they made any such regulation, and that was what I was getting at. I believe that is all, you may take the witness.

Commissioner Walker. With the gas shortage you have suffered year after year, in what months does the shortage occur, mostly?

A. The latter part of November, December and January. Naturally, the cold months of the year.

Commissioner Walker. You have never had a shortage in February?

A. Yes. We had no shortage last February. We did have some- [fol. 351] what of a shortage in February, 1918.

Commissioner Walker. Do you remember how long that lasted?

A. Just a few days. The acute shortage was January 1918, and December, 1918. I was not here in January, nor was I here in February of 1918.

Commissioner Walker. That was the year when Mr. Molinard kept watts wearing a fur coat was it not?

A. I think so, yes sir.

Cross-examination.

By Mr. Fulton.

Q. This house that you lived in and owned, what was the nature of the apparatus you had there before you made the change? What kind of a range did you have, cooking range?

A I used the same range. I had a Garland range that we bought when we were married, and that is several years ago.

Q What changes were made in that range?

A The change was a drilling out or opening up of the mixer spud. I believe that was drilled out somewhat.

Q To let out more gas?

A At the lower pressure, yes, and adjusting the air chamber on the mixer.

Q Did you raise the burners?

A We did not. We had an open grid on that range and the fire was adjusted so it came in contact with the vessel.

Q What sort of heating apparatus did you have?

A Fire place and a gas log.

Q What adjustment did you make on that?

A A slight opening of the mixer spud. I did not make those adjustments myself, but the service was satisfactory after it was made.

[fol. 352] Q What change did you make in the furnace?

A Put in a natural gas furance.

Q What was the name of it?

A I have forgotten the name of it, but it was a burner that Mr. Mugge sent away for.

Q Was it a Bunsen burner?

A No, it was not that. I know something, however, about the Bunsen burner.

Q How much did it cost you to procure that burner and have installed, approximately?

A All the changes?

Q Yes, I want to know about that too, but I want to know about the burner.

A I don't know about the burner.

Q It would be somewhere—I don't know, about three or four dollars for the kitchen range?

A Yes, that would be negligible, but it would cost more to make the change in the furnace. I suppose it cost $20.00.

Q That thermostat, how much did that cost?

A Thirty-five or forty dollars.

Q That Thermostat merely regulates the heating?

A It does this. It has a clock arrangement so connected that you can set the mechanism so that during the night if you want to maintain say 60 degrees Fahrenheit in your room, or 70, that when it gets warmer than that it automatically closes a valve on the line leading to the furnace, and when it cools down below that point they will open up again, so that an even temperature is maintained, and you can set it so that if at five o'clock in the morning you want it to increase to 70 degrees it will open up the valve.

Commissioner Walker. It operates very much on the same principle as the hot water heater?

[fol. 353] A Yes sir.

Q That arrangement you had put on the pipe to regulate the furnace, what did you call that?

A Regulator. I believe it was an Enco regulator.

Q Is that Thermostant necessary to the efficient use of gas?

A Oh no, that is purely a matter of convenience. I will say this——

Commissioner Walker. That saves getting up and lighting the fire.

A Well, it saves more than that.

Q It saves the danger by the sudden increase of gas——

A Yes, and it eliminates the danger of the human element that enters into it—items of this nature, the case I had in mind is when we shut off the gas, or don't do it rather, but let the temperature get too high, and the house gets too warm, and thereby gas is wasted. More heat than is necessary. Personally, I believe the thermostat makes for economy.

Q That regulator that was put on, where was that put, before or after the meter?

A On the outlet side of the meter.

Q How much would it take to install it?

A Around ten dollars. Cost more now than then.

Q So a person could make those changes in the ordinary heating apparatus such as you have mentioned, aside from the thermostant for twelve, thirteen, or fourteen dollars?

A Not with a furnace.

Q Oh, I forgot that.

A I should say they could make it for fifty dollars. It would depend wholly on your furnace. Nobody could tell at this long range what kind of a change you would have to make in the furnace. [fol 354] Q What kind of a furnace was that one you had, how was it operated?

A It was controlled by four—as I remember it—separate valves and each of those valves controlled several sections of the furnace. It was in effect a Bunsen burner so located that the apex of the flame would come just in contact with the bowl of the furnace raised to the proper height, that is to the height where the body of coal is supposed to be in a coal burning furnace, so that you would have all the opportunity of taking in secondary air underneath, and at the same time communicate your heat to the shell.

Q Now Mr. Owen, is it not a fact that the books of your Company show that you sold more gas than you received?

A No sir.

Q I ask that in good faith. I either heard it, some one told me, or I saw it in a newspaper that the amount your consumers paid for gas showed that they received, or at least paid for more gas so far than you had received from the Oklahoma Natural?

A I cannot imagine where such a ridiculous thing could arise. The only possible way that I could see how such a thing could happen was that the check-meter at the city limits was wrong.

Q That is not the way they interpret it. You know how they interpret it, don't you?

A While on the subject of meters, I would like to make this

statement. If Mr. Richardson wants it out of the record, all right, and if not, all right.

Mr. Richardson. No, let it go in the record.

A. It is for the benefit of the Commission, and that is this: That our meters are tested at two inches of water pressure. Not on four ounces pressure, but they are tested on what is practically 1 ounce [fol. 356] pressure. Tested to be accurate on 1 ounce pressure.

Q. Could not a person have his adjusted at the range or other heater for two ounce pressure, and regulate it merely by the valves?

A. Yes sir.

Q. So there is no absolute necessity of putting in the regulator?

A. Only that you would not need what pressure you were getting.

Q. You could tell when you go to light your appliance?

A. It could be done.

Mr. Richardson. He could tell whether he had the flame the height he wanted it?

A. Yes, a regulator is nothing more than an automatic valve.

Q. Now you say the amount of gas that was consumed in the city last December was more, or less than was consumed in November, which was it?

A. Less. The supply was decreasing.

Q. And was the amount that you received, less or not that month too? Do you know now, or are you just guessing?

A. No, I don't know.

Q. My bill was twice as much.

A. I think probably that during November quite a considerable amount of gas was used at the lower rate and practically all gas used in December was by domestic consumption which was a higher rate.

Mr. Richardson. Might not the time his meter was read have something to do with the November bill?

A. Yes.

Q. I am not complaining, I have had all the gas I wanted. I did not have a gas shortage, but it is a surprising statement that there was less gas in December, when I have heard so many people [fol. 356] say their bills were so much larger in December. I mean the domestic consumption.

A. My bill at my home was larger, but I used more gas.

Q. You would not use any more than anybody else in proportion to what you did before?

A. It would depend on the weather.

Q. Of course I would use more gas too when it was cold, and so would everybody else, and yet you did not have as much gas as you had in November?

A. There was considerably less gas used in domestic consumption in November than in December.

Mr. Fulton. That is all.

(Witness excused.)

[fol. 357] Mr. John T. Naylon, being called as a witness on behalf of the respondent, being first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Your name is John T. Naylon?
A. It is.
Q. And you live in Oklahoma City?
A. Yes sir.
Q. Mr. Naylon, you are connected with the Oklahoma Gas & Electric Company?
A. I am.
Q. In what capacity?
A. Gas Efficiency Engineer is the title.
Q. How long have you been with the Company in that capacity?
A. Since July, of 1919.
Q. Did you succeed Mr. Muggs as Gas Efficiency Engineer for the Oklahoma Gas & Electric Company?
A. I did.
Q. What are your duties as Gas Efficiency Engineer, Mr. Naylon?
A. To co-operate with the gas consumers of Oklahoma City, and other cities where the Oklahoma Gas & Electric Company distributes gas to consumers, and to co-operate with consumers in securing better service and better results from the gas that they use.
Q. Have you had any education or training along that line, if so, state what it is?
A. I graduated from the University of Michigan in 1915.
Q. How many years did you spend there?
A. Four.
Q. What degrees did you take?
A. I took in 1915 a Degree of Bachelor of Chemical Engineering [fol. 358] and in 1916—from the fall of 1915 to the summer of 1916—I was a graduate student at the University of Michigan, holding one of the Fellowships in Gas Engineering issued by the Michigan Gas Association. At the end of that time I received a Degree of Master of Science in Engineering.
Q. After you left the University of Michigan, what did you do?
A. I entered the employ of the Detroit City Gas Company, as Industrial Engineer. The duties consisting of sales, installations, operation and service on gas burning appliances for the industrial consumer.
Q. After you left that Company, what did you do?
A. I was with the Detroit City Gas Company until May of 1917 when I left and entered the Army.
Q. How long were you in the Army?
A. I was discharged April 5th, 1919.
Q. And you came with the Oklahoma Gas & Electric Company when?
A. July, 1919.
Q. And you have been with them ever since?

A Yes. Between the time I was discharged and the time I came here I was with the Ford Motor Company, at Detroit, Michigan, on gas conservation, or gas efficiency work to try to reduce their gas bills.

Q That is in the use of carburetors?

A No, sir, manufactured gas.

Q The gas they used in their factory?

A Yes sir.

Q Are your services free to the public in the matter of inspecting their premises, their piping, their stoves, furnaces and ranges and the burners and appliances with which they consume the gas?

A They are.

[fol. 359] Q They are free to the public in Oklahoma City?

A Yes.

Q Are they so advertised by the Oklahoma Gas & Electric Company as being free?

A Yes.

Q Your business is to examine those appliances, inspect them, and tell them whether or not they are of the proper kind and whether or not they have proper adjustment?

A Yes sir.

Q And to undertake to enable the consumer to have efficient combustion of his gas and to utilize the heat that the proper combustion of the gas generates?

A That is correct.

Q Do you maintain a laboratory for demonstrating matters of that kind?

A We do.

Q Do you maintain at your plant a demonstrating system for making demonstrations such as Miss Elfritz of the United States Bureau of Mines made here the other day?

A We do.

Q Do you make those demonstration to the public free of charge?

A We do. I have not made public demonstrations in Oklahoma City since my connection with the Company.

Q Are you prepared to make them at any time the public wants to see them, or anybody?

A Yes sir.

Q Have your services been called for by the public very much?

A They have. In increasing volume. The business has increased very materially since Thanksgiving.

Q Mr. Naylon, as an illustration of the situation that exists, you might state to the Commission what you found at my house about [fol. 360] a month ago?

Mr. Fulton: Don't tell everything you found.

Mr. Richardson: With the Commission's permission, and that of the attorney on the other side, I will state that I had just bought the house and moved into it, and I called in Mr. Naylon to examine the gas and see why my gas was not burning efficiently, and you might, as an illustration, tell what you found there?

A. I was called to Judge Richardson's home to look over the entire proposition as regards the gas bill and the operation of the appliances. The first appliance, so to speak, that was inspected, was of course the service line from the street. I have here a form that is filled out by the efficiency department of the Oklahoma Gas & Electric Company here, in every case so that we have as a record in our office the results obtained from these inspections.

Q. Did you make this inspection when you were requested?

A. As in the case of all domestic consumers, yes. In the case of Industrial consumers, last summer and early in the fall I personally went to the larger consumers here to see what we could do for them in the way of reducing their fuel bills. After looking over the service pipe in Judge Richardson's home, which was one inch, we recommended that the service line be increased to two inches. I should say that we decided the service pipe was not large enough.

Q. That was an eight room house?

A. Yes. We then proceeded to look over the inside piping and the appliances in the house to determine the proper size service pipe that should be run to replace the one inch service pipe. This was determined as two inches. I took up the proposition with Judge [fol. 361] Richardson direct, and explained the changes that were necessary to make in the service pipe. I spoke to him about the installation of a house regulator, explained to him its advantages, gave him an approximate estimate on the cost of the same, then we took up the hot water boiler, the hot water furnace which he had in his home.

Q. That is, my house is heated by hot water?

A. Yes sir, and there were some suggestions made regarding raising the burners and changing the position of the burners whereby the heat generated from the combustion of the gas could be utilized. We took up the next question.

Q. I might ask you also to state whether you found the damper wide open and all the heat going up the chimney?

A. Yes sir, in this case we did. We talked that proposition over and Judge Richardson was advised to watch that and to cut down on the damper as much as possible without impairing the combustion of the gas inside the fire box. The next thing we took up was the kitchen range. We went into some detail on that, changed the manifold, raising the burners, removed the closed top so that the burners could be put in the proper position. Some other questions with regard to small changes were taken up regarding the vine lines in the upper part of the house, and Judge Richardson advised me that his intentions were to replace the gas grate with an appliance which has recently been put on the market, and to replace the gas logs. As he had already signified his intention of securing that device, nothing else was said.

Q. That was the Radiantfire?

A. Yes. In that connection, I have had cases of that in lots of complaints of high gas bills, seemingly high gas bills. We go out and ask the consumer to light the logs. There usually is a log, and that usually determined that that is the cause of the supposed ex-

[fol. 362] cessive bill. We turn everything else off and watch the meter operating on the logs alone, and they will vary from 50 cubic feet an hour to as high as 200 feet an hour, some of them burning from five to twenty four hours a day. The Radiantfire on the other hand, burns on a maximum of 50 feet an hour, with the floors getting the full heat.

Mr. Fulton. Why do those logs consume so much gas, if you have the same size pipe and turn it on to a certain place and the same amount of gas comes out of it, how can they consume so much?

A. The gas log does not follow out the correct principle of combustion. Miss Elifritz day before yesterday spoke of the drilled burner whereby the individual tip of the flame is surrounded by a coating of air, which we call secondary air, and is the air that enters into the combustion and does not come in through the mixer. It is essential in all cases that the flames be individual and not have one bump into the other. That causes the very noticeable odor you can get from the gas log. Another thing, in heating with a gas log you depend on diverted heat. With the kitchen range your gas is burning here (indicating) and your vessel is here (indicating directly above) so as to absorb that heat. With the gas log, the log is here (indicating position of log) the chimney is here, (indicating directly above) and you are merely heating up the outside air. The radiated heat is very small.

Q. I understand that, but why can it use any more gas than any other burner?

A. It has more openings. Each of those individual openings on the gas log is precisely the same as the drilled hole in the range burner, but you have a lot more holes in the gas log, and naturally they burn more gas.

[fol. 363] Mr. Fulton. Excuse me for interrupting, but I was interested.

Mr. Richardson. That is all right. Now Mr. Naylon, what is the proper size service pipe for a house of from four to six rooms?

A. An inch and a quarter minimum.

Q. What would be the proper size for a house from six to ten rooms?

A. A two inch minimum.

Q. What would be the proper size service pipe for a house from—oh say ten to thirty rooms?

A. That would be heating with—it would have to be a large size—or would they be heated through a secondary heating plant?

Q. I expect I have taken too large a range, from ten to thirty, there might be grades in between that. Let me ask you this question. Would a service pipe of two inches be adequate for a house of ten rooms?

A. I would say no. How large a house?

Q. Ten rooms?

A. I would not recommend a two inch pipe for a house of ten rooms, no.

Q What size would you recommend?

A Two and a half. We don't figure on two and a half very much. It usually jumps from two to three.

Q You saw that house Mr. Rogers lives in?

A I did.

Q Do you know how many rooms there are in that house?

A From what Mr. Rogers said.

Q Say there were twelve different meters, twelve separate accounts—thirteen accounts, one meter supplying the hot water heater, so assuming there were 12 apartments of from three to four rooms each—that was what Mr. Rogers testified there were—12 suites or apartments, of three to four rooms each?

[fol 364] A As I recollect it, yes.

Q That would be a house ranging from 36 to 48 rooms?

A Yes sir.

Q What size service pipe was there?

A An inch and a quarter.

Q For all of those twelve families and the Rudd heater?

A Yes sir.

Q Was that adequate?

A No sir.

Q Would that be adequate in extreme cold weather under most any gas pressure?

A I would say no.

Q What was the condition of that Rudd heater?

A The Rudd heater, the copper coils on the heater were covered with a very dense coating of carbon.

Q That is the soot generated by the imperfect combustion of the gas?

A Yes, and there were long cobwebs of carbon suspended from some of the coils in this heater.

Q What effect does that carbon catching on those coils and festoons of carbon hanging from the coils have, with respect to the application of the heat from the gas to the coils?

A Carbon is a very good heat insulator.

Q It is a non-conductor of heat?

A Yes sir.

Q And that would prevent the transmission of the heat generated by the combustion of the gas to the coils there so as to heat the water properly?

A It would.

Q You were there with Mr. Crutcher, were you?

A Yes sir.

Q Do you know, from your observation and experience in Okla-[fol 365] homa City as the Gas Efficiency Engineer for the Oklahoma Gas & Electric Company, since you have been here, have you seen enough of the homes in Oklahoma City, and the methods and manner in which they were piped, both with respect to the service pipe and with respect to the laterals running from the service pipes to the various rooms and appliances, do you know about what per-

centage of the homes in Oklahoma City are properly pipes? Do you or not?

A. I should say that about 25%—you might say that 25% were properly piped.

Q. That has been your observation so far?

A. Yes sir.

Q. What would you say as to the other 75%?

A. The other 75%, probably about 50% of the houses, more than that,—60% have small inside pipings, with a great number of bends in the piping. More than necessary.

Q. By inside piping, you have reference to the laterals running from the service pipe to the various rooms and appliances?

A. Yes, we speak of inside piping as being the pipe between the meter and the appliances. About 50% have too small inside piping, and 50% too small service pipe.

Q. Does the small inside piping—by that I mean the inside piping that is too small, have just as bad effect upon the rendition of the service as a service pipe that is too small?

A. No, it does not?

Q. Does not have as bad an effect?

A. No, because the service pipe affects the whole house while the small inside piping may effect just one stove or a few appliances.

Q. If the inside piping were too small they would be as bad off as if the service pipe was too small wouldn't they?

[fol. 366] A. Yes, if all their inside piping was too small.

Q. I presume there are some cases where both the service pipe and the inside piping is too small?

A. Yes sir.

Q. And I presume there were some cases where only the service pipe was too small?

A. Yes.

Q. And I presume there were some cases where only the inside piping was too small?

A. Yes.

Mr. Richardson. That is all.

Commissioner Walker. How much gas is it possible to put through a two inch line?

A. Of what length?

Commissioner Walker. Well, say five miles?

A. I would have to compute that.

Mr. Richardson. Five what? I didn't understand that?

Commissioner Walker. Five miles. Talking about not being able to supply families with an inch and a quarter pipe we have cases where towns were being furnished through a two inch line.

A. At what pressure?

Commissioner Walker. I suppose all it would stand. Eighty or ninety pounds.

A. The flow of gas depends on pressure.

Commissioner Walker: Well, take the little town of Garber, I think that starts with a six inch and then reduces to four. Where it goes off from your lines, and then it runs for about three miles with a two inch line. That line is on top of the ground too. Of course, they are complaining constantly about not having gas enough, and I was wondering how many people they could serve through that line?

[fol. 367] A. I would have to compute that.

Commissioner Walker: I realize there is a difference where you have the natural pressure and you would not have the high line pressure in the service pipes.

Mr. Richardson: I understand that depends on the in-let and the out-let pressure. In other words if you get your application with the pressure registered by pounds as against ounces you have a different proposition altogether, and also it depends on the length of the line because the line acts as a storage. I understand Mr. Crutcher has tables with respect to that and he may answer the question.

Mr. Crutcher: Yes, I have tables for working out any proposition he might ask.

Commissioner Walker: The question just went through my mind if you could not furnish a large house with a two inch pipe what the situation was where they were supplying a town with a two inch pipe.

Mr. Crutcher: I was in the town of Garber investigating the supply last fall, and they were not getting gas enough through that two inch line to give any service at all.

Mr. Owen: May I volunteer this information. The carrying capacity of any line of a given size depends first on the initial, and out-let pressure, and the length of the line. All of those are factors in determining the amount of gas any line will deliver.

Commissioner Walker: Then the shorter the line the more gas it will deliver?

Mr. Owen: Yes.

Commissioner Walker: This gets down to where it runs from the curb to the house?

Mr. Owen: Yes, but you only have a six ounce pressure at your [fol. 368] curb. It is possible with an inch and a quarter line, with four or five pounds pressure on your line to deliver of course any amount of gas any consumer might need, but you have a fixed in-let pressure for your service pipe. That is what you have to figure on, and you have got to compute your discharge of the line from the fixed in-let pressure, taking into consideration the demand at the other end of the line. The demand at the other end of the line will cause a drop in pressure, and you have to figure the minimum drop that will be allowed in that line to give any service. I don't know whether you catch my thought or not. For instance, say you needed to deliver at a given house a maximum demand—and you have to figure on a maximum demand, as we do on the distributing system, of say a maximum of 500 feet an hour. Then it is an easy

matter when you know you have 6 ounce pressure on your main, and you know the length of your service line, it is an easy matter to determine what size pipe it will take to deliver that maximum demand at a given pressure which will be economical for the consumer and give efficient service. All of those things are based on that sort of computation.

Mr. Crutcher: At the time I was at Garber, at the well, six miles off, they had 50 pounds pressure. Six miles of two inch pipe between the two. That secured practically one pound pressure at Garber. With fifty pounds pressure at the well it would be possible to deliver 6,000 feet per hour through that two inch line.

Mr. Richardson: If you figured that at six ounce pressure, and count the service line we will say 80 feet long, running from the curb to the meter, with six ounce pressure in the main, what would the result be? Figure both at six ounces, and four ounces where it leaves the main.

[fol. 369] Commissioner Walker: Figure on two ounce pressure?

Mr. Crutcher: These tables are worked out under pressure measured by inches of water, and the proper pressure loss is shown here at two inches of water. We cannot have zero at the appliance. A two inch line under that condition will deliver about 1,500 feet an hour.

Mr. Richardson: Two inch?

Mr. Crutcher: Yes sir.

Mr. Richardson: What would a one inch line deliver?

Mr. Crutcher: 300 feet.

Mr. Richardson: A two inch line would deliver five times as much as the one inch?

Mr. Crutcher: Yes sir.

Commissioner Russell: How much loss did you allow from the intake at the street to the end of the service line?

Mr. Crutcher: One inch.

Commissioner Russell: How much loss in pressure?

Mr. Crutcher: One inch of water.

Commissioner Russell: One inch, or one ounce?

Mr. Crutcher: One inch. It is always based on inches of water. One inch is based on a liberal allowance.

Commissioner Russell: That would mean about a half an ounce then?

Mr. Crutcher: Yes sir.

Commissioner Russell: I thought you said you could not figure two ounces because it would put it zero at the appliance. If that is the case I thought it would put the consumer in a rather bad shape.

Mr. Crutcher: One inch is too liberal a loss to allow.

Mr. Richardson: Do you want to cross-examine Mr. Naylon?

Mr. Fulton: Yes, a few questions.

[fol 370] Cross-examination (of Mr. Naylon):

By Mr. Fulton:

Q What size pipe should you have in an eight room house with a two inch service pipe, what size pipe should you have inside the house?

A You mean to the furnace?

A Yes, or to the range?

A Our recommendation as to that, we like to have the furnace on an independent lateral from the meter to the manifold, because the furnace with a stack, if the stack is improperly operated sometimes has a tendency to rob the other appliances. If you had a two inch service and the distance from the manifold of the furnace to the meter was not more than fifteen feet I would say an inch and a quarter. If it is more than 15 feet, say from 15 to 30 feet, or 15 to 25 feet I would say an inch and a half. Then coming from the feed line the other way, to your different appliances which would come off from there, depending on the number of appliances being used, but to supply the range alone, if in the basement you run an inch and a quarter lateral along the ceiling of the basement and put a line up from there, I should say not less than three quarters of an inch to the kitchen range, if the distance is not too far. Distance is a factor in determining the size of the pipe.

Q Take this situation. Supposing the pipe is all right in the house, an eight room house, supposing it has an ordinary gas range, say two heating stoves, a small heating stove, a furnace, and fire place, what would be the approximate cost of adjusting that to a two ounce pressure, that is to put in additional appliances that might be necessary to make that efficient. To make an efficient furnace, and the ordinary gas range, and an ordinary fire place.

[fol 371] A Is that fire place a gas log, by the way?

Q Yes.

A That is a pretty hard question to answer. The first thing I would do in your case would be to install a low pressure regulator.

Q That would be about ten dollars?

A Yes, about ten dollars. Then an inch and a quarter pipe—you would have to change the piping—if there is pipe to be changed that is hard to estimate.

Q I want to know outside of the piping?

A Then the burners in the hot air furnace, what kind are they?

A I don't know, it is a circular business down at the bottom with holes in it throwing out the flames—the flames come up this way (indicating). The burner Mr. Owen had in his home he said would be about twenty dollars?

A That was two years ago. It would be about thirty now. The replacement of the gas log with the appliance burning gas as it should—an appliance similar to Rad. antfire—Radiantfire would cost you pretty close to fifty or sixty dollars, that would bring it up to about eighty dollars.

Q That would bring it all up to about $100.00 then?

A That is without any change in the piping. Then I also would

recommend in a case like that the installation of a Minneapolis heat regulator, or an appliance of that type, such as Mr. Owen had.

Q. That is a thermostat?

A. Yes, it is not a gas saver except it reduces the personal equation and also tends to comfort a great deal.

Q. Now assuming that brings your gas up to an efficient standard, what would be the per cent of reduction on the amount of gas used there as compared with what was used before?

A. I would say that that would save pretty close to 60 or 70 per [fol. 372] cent on the logs. We could save on the cooking probably 30 or 40 per cent. On water heating——

Q. What change would you make on the water heating? What I have is an ordinary coil attached to the hot water tank?

A. The water heating proposition is about the same as it runs into a kitchen range, would be raising the burner to get the tip of the flame. Have you a tank heater?

Q. Yes?

A. Well, the first thing I would do there would be to look at the inside of the coils. It has been known that by cleaning out and putting in new coils you can save 20 per cent.

Q. How much would you say you could save on the furnace?

A. The furnace would save—I would say we might save you 20 per cent on the furnace, but if you have a coal furnace and burning gas in it, and should replace that with a gas burner and burn gas in it, we could save you 75 per cent.

Q. And it would cost $30.00 to make the change in the furnace?

A. Yes.

Mr. Fulton: That is all.

Commissioner Walker: When you put in a burner to use straight gas, could you use that for coal?

A. You mean if you had a furnace designed for gas could you burn coal in it?

Commissioner Walker: Yes.

A. No.

Commissioner Russell: You had better keep the condemnation, Judge.

Mr. Fulton: Now you needn't worry about that.

Commissioner Russell: We might make an order next winter not to allow you to use gas in your furnace anyhow.

Mr. Fulton: The proposition as I understand they make is that we have got to get down to a two ounce pressure and I was wonder- [fol. 373] ing how much it was going to cost the people to cut down to it.

Commissioner Walker: There is no question but what we will have to come down to it because we don't have gas enough to go around.

(There being no further questions, the witness is excused.)

Mr. R. C. Sharp, being called as a witness on behalf of the respondent, being first duly sworn, testified as follows:

Direct examination

By Mr. Richardson:

Q. Your name is R. C. Sharp?
A. Yes sir.
Q. What position do you hold in the Oklahoma Natural Gas Company?
A. Vice President.
Q. How long have you been Vice President of that Company?
A. Three years.
Q. As Vice President of that Company, are you active in the Company?
A. Yes sir.
Q. Active in the management of it?
A. Yes sir.
Q. And are more or less familiar with the affairs of the Company?
A. Yes sir.
[fol. 374] Q. What is the present capital stock of the Oklahoma Natural Gas Company?
A. Fifteen Million dollars, $14,300,000.00 issued.
Q. Do you know about what the value of the property of the Oklahoma Natural Gas Company is that is used and useful in carrying on the natural gas business?
A. In excess of twenty million dollars.
Q. How many miles of pipe line of all sizes has the Oklahoma Natural Gas Company in use?
A. Approximately eleven hundred.
Q. Its main pipe line runs from the Northeastern to the Southwestern portion of the State?
A. Yes sir.
Q. How many compressor stations has it?
A. Five.
Q. Those compressor stations are used for the purpose of pushing the gas through the pipe line to the consumer is it?
A. Yes sir.
Q. Ask you to state whether or not the Oklahoma Natural Gas Company has ample transportation facilities to enable it to furnish to Oklahoma City and to its patrons an adequate supply of gas?
A. Yes sir.
Q. How many pipe lines has the Oklahoma Natural Gas Company running into Oklahoma City?
A. Two.
Q. One of them is a double line, is it not?
A. Yes sir, with the exception of about a mile and a half in the city.
Q. One of its lines run from the northeastern part of the state into the city, and is of what size?
[fol. 375] A. Twelve inch.

Q Then another line running from the Morrison field to Wellston, and is double from there in?

A To within about a mile and a half of the city.

Q And what is that size?

A Twelve inch.

Q That is two 12 inch lines there?

A Yes sir.

Q Then you have a line from the South coming into Oklahoma City have you not?

A Yes sir.

Q What size is it?

A Twelve inch into the city, thirty-five miles on the lower part of it is 16 inch.

Q So in fact you have three lines?

A Yes sir.

Q If gas was available for that purpose, how much gas could you put in Oklahoma City with those three lines daily?

A At least 75 million feet.

Q And in the winter time, with industrial consumption on 30 million feet is adequate I believe they testified?

A Yes sir.

Q The Oklahoma Natural Gas Company does not contend that there was an adequate supply of gas for all of its patrons in the months of November, and December, 1919, I understand?

A No sir.

Q Ask you to state whether or not the fact that there was not an adequate supply of gas during the months of November and December, 1919 was due to any negligence or indifference on the part of the Oklahoma Natural Gas Company?

A It was not.

Q Tell the Commission whether or not the Oklahoma Natural [fol. 376] Gas Company did make all effort within its power to procure and furnish an adequate supply of gas?

A We did.

Q Now I will come to the details of that later. Ask you to state to the Commission whether the supply of natural gas available in the State of Oklahoma has been diminishing, and is failing?

A Very decidedly so in the sections that our lines cover.

Q I will ask you to state also whether or not the shortage of gas in November and December 1919, was local and confined only to the Oklahoma Natural Gas Company, or whether it was nation-wide?

A It was nation-wide.

Q Do you know whether or not it was so acute, and so nation-wide that the Secretary of the Interior called a conference of the Governors Public Utility Commissions, and Natural Gas Companies to be held in Washington, on the 15th of January, 1920? For the purpose of devising means of conserving the nation's rapidly failing supply of gas?

A Yes sir.

Q Did you attend that meeting?

A. Yes sir.

Q. I will ask you to state to the Commission, has the Oklahoma Natural Gas Company used and got gas out of what is known as the Hog-Shooter field?

A. Yes sir.

Q. Where was the Hog-Shooter field?

A. It was near Bartlesville. That was before my time.

Q. That was a very large field of gas, in very large quantities when it was first opened up?

A. Yes sir.

Q. Does the Oklahoma Natural Gas Company get any gas out of [fol. 377] the Hog Shooter field now?

A. No sir, we intended to lay a line there, but the supply failed before we got to it.

Q. You used to have a line in there didn't you?

A. The Caney River had a line in there.

Q. And the Oklahoma Natural Gas Company acquired the Caney River Gas Company?

A. Yes sir.

Q. Were you going to lay another line in there?

A. We were going to put in a larger line.

Q. Is there any gas in the Hog Shooter field now?

A. Not to my knowledge.

Q. That field had become exhausted before you became connected with the Oklahoma Natural Gas Company?

A. Yes sir.

Q. Now did the Oklahoma Natural Gas Company ever get any gas out of the Glenn Pool?

A. Yes sir.

Q. The Glenn Pool was a very large pool of both oil and gas that was developed near Sapulpa?

A. Yes sir.

Q. Is there any gas in the Glenn Pool now?

A. I don't think so. They have repeatedly called on us to let them have gas for their school.

Q. That is out of your pipe line?

A. Yes, for the school at Glenn Pool.

Q. Is the Oklahoma Natural getting any gas out of the Glenn Pool now?

A. No sir.

Q. Ask you whether or not some month and a half or two months ago the town of Kiefer, situated in the Glenn Pool, which is a town of about 1,500 inhabitants, filed an application with the Cor- [fol. 378] poration Commission to require the Oklahoma Natural to furnish that town gas out of its pipe line because all of the gas in the Glenn Pool was absolutely gone?

A. Yes sir.

Q. And they undertook to require the Oklahoma Natural to do that did they, after that gas has been exhausted in so far as the quantity that would be required by the Oklahoma Natural Gas Company is concerned, for years, in the Glenn Pool?

A. Yes sir.

Q. Have you with you a statement of the amount of gas, the open flow volume of gas which the Oklahoma Natural Gas Company had available on the 1st day of November, 1919?

A. Yes sir.

Q. And have you also a statement as to where that gas was located?

A. Yes sir.

Commissioner Walker. What date?

Mr. Richardson. This is of date November 5th, 1919.

Q. What was you total open flow volume of gas on November 5th, 1919?

A. 583,163,662 feet.

Q. Of that quantity of gas, under the laws in force in Oklahoma, and under the rules and regulations of the Corporation Commission, you were entitled to take what quantity?

A. Twenty five per cent.

Q. 25% of the open flow, which would be about one hundred and forty-eight or nine million cubic feet per day, would it?

A. Yes sir.

Q. That quantity would have been adequate would it not for your pipe lines?

A. It would have.

[fol. 379] Q. You furnish other towns besides Oklahoma City, I understand?

A. Yes sir.

Q. About how many others?

A. About thirty-seven or eight.

Q. Towns and cities?

A. Yes sir.

Q. In the table which you have prepared, I will ask you whether or not this table of open flow volume and pressure table of November 5th, 1919, and 18november 1st, 1919, is true and correct?

A. Yes sir.

Mr. Richardson. I now hand the paper to the reporter with the request that the same be marked as Respondent's exhibit 5 for the purpose of identification.

(Thereupon the same is so marked.)

Q. Now Mr. Sharp you had made arrangements and provided for this quantity of gas in the winter time?

A. Yes sir.

Q. I presume you felt like the Christian mentioned in the Bible, whose barns were full and overflowing, and ready to take life easy?

A. We had made such large expenditures, and the supply had been so good in the summer and fall that we were really welcoming winter to come.

Q. You really thought you would have lots of gas?

A. Yes sir.

Q. I notice in exhibit 5, in the Okmulgee-Beggs district, you had a rock pressure of 381 pounds on November 5, 1919?

A. Yes sir.

Q. And a total open flow volume of 138,475,910 feet, is that true?

A. Yes sir.

[fol. 380] Q. And of that you could take 25%.

A. Yes sir.

Q. In the Mounds district you got gas also, did you?

A. Yes sir.

Q. By December 1st, what had your Okmulgee-Beggs district gone down to?

A. 62,726,320.

Q. That had gone down from 138 million to 62 million?

A. Yes sir.

Q. I notice to the right of that column, "Open flow not available on account of insufficient rock pressure," what does that mean?

A. That is in that district in certain wells the rock pressure had become so low that the pressure in the line was greater than the pressure from the well and the gas would not go into the line.

Q. Then if there was a connection from your line to that well, the line would put gas into the well instead of the well putting gas into the line?

A. Yes sir.

Q. In the Mounds District, which on November 5th showed what?

A. 73,968,930.

Q. And by December 1st, 1919, what had that gone down to?

A. Thirty-two million in round numbers.

Q. That made a decrease of about forty million cubic feet in one month?

A. Forty One million.

Q. Ask you to state what the pressure in the Mounds District went down to?

A. In the Mounds District the pressure fell off from 323 pounds to 199 pounds.

Q. Mr. Fulton has suggested to me that this will be offered in the [fol. 381] record and it is not necessary to go over it all, and I believe he is right about it. This shows that you were taking gas from eighteen different fields in the state?

A. Yes sir.

Q. Are those districts, some of them, far removed from others?

A. Yes sir.

Q. I notice the Walters district, what part of the state is that located in?

A. The Southern part. I think it is 109 miles from Oklahoma City.

Q. The Morrison district is what direction from Oklahoma City?

A. Practically straight north.

Q. About how far?

A. About 85 miles.

Q. And Broken Arrow district is in what direction?

A. East.

Q. How far?

A. About 140 miles.

Q. And the Osage, what direction is that from Oklahoma City?
A. East.
Q. Northeast, is it not, more North than East?
A. Yes sir, that is right.
Q. How far is that?
A. To the end of our pipe line?
Q. Yes, in the Osage district?
A. 152 miles.
Q. Has the Oklahoma Natural acquired gas in all of those eighteen different districts that is represented on this Exhibit 5?
A. Yes sir.
Q. Has it acquired all the gas it could acquire in those different districts?
[fol. 382] A. Yes sir.
Q. Was this all the gas that has been developed any where in the state in the vicinity of your pipe line that was available to you?
A. Do you mean that was available in sufficient quantities to guarantee the investment to go after it?
Q. Yes.
A. Yes sir.
Q. Is this all the gas in the vicinity of your pipe lines that is available to you any way. I am not talking about building new pipe lines to other places now?
A. Yes sir.
Q. Do you know of any other fields of gas in the state of Oklahoma that is producing gas in such quantities, and which you could acquire by any expenditure within reason, that produces gas in such quantities as would justify the investment in a pipe line to go after it?
A. No sir.
Q. I want to call your attention to the Morrison gas. This exhibit 5 shows that on November 5th, 1919, you had an open flow volume of 22,862,550, with a rock pressure of 198 pounds?
A. Yes sir.
Q. You say on December 1st, 1919, none of that gas was available to you, and that there was still an open flow of about fifteen million feet, with a rock pressure of 174 pounds. Why was that gas not available?
A. Did not have sufficient pressure to put it into the line.
Q. What was the pressure in your line?
A. The night pressure was possibly 200 pounds, and the day pressure would be possibly 200 pounds.
Q. And if the pressure at the well was only 174 pounds it would not put it into the line?
[fol. 383] A. No sir.
Q. Was that available to a compressor station?
A. No sir.
Q. Are you now connecting that line up with a compressor station any where?
A. Yes sir.
Q. How long a line do you have to build in order to connect that with a compressor station?

A. Approximately ten miles.

Q. What will be the cost of that line?

A. From One Hundred, to One Hundred and Twenty Five Thousand Dollars.

Q. That is what is called low-pressure gas, and can be put into the line only by compression that will create a pressure greater than the line pressure?

A. Yes sir.

Q. I will ask you to state what this 585 million cubic feet of open flow that you had on November 5th, 1919, had gone down to on December 1st, 1919?

A. To 345,446,410 feet. I believe on December 22nd, 1917. No, I believe it was January, 1918 we finished the line into the Morrison field which then had an Open Flow volume of 90 million feet, with an average rock pressure of 800 pounds, and that is now under 114 pounds, with an Open Flow volume of 15 million feet, and the chances are that as soon as we put it on the compressor station that it will cut it into two again, within thirty days.

Q. On the 1st day of December, 1919, your total open flow volume available to you had gone down from 585 million, which was adequate, to 345,985,803?

A. Yes sir.

Q. In round numbers, about 346 million feet, of which you could [fol. 384] take 25%, or about 86 million feet?

A. Yes sir.

Q. Was that adequate or not?

A. No sir.

Q. That represents a falling off in 9 months when you began to draw on the line for the extreme cold weather of almost 200 million feet don't it. Or, more than 200 million?

Commissioner Russell. 240 Million cubic feet.

A. Yes sir.

Q. That counted even the open flow where the pressure was too low to put it into the line. It showed a reduction of 240 million feet in so far as gas available was concerned, that is, gas having sufficient pressure to get into the line is concerned?

A. Yes sir.

Q. Now have you any table showing the condition with respect to January 1st, 1920?

A. Yes sir.

Q. Is this it?

A. Yes sir.

Mr. Richardson. I hand these to the reporter and ask that this be marked as Respondent's exhibit 6, for identification.

(Thereupon the same are so marked.)

Mr. Richardson. We now offer in evidence Respondent's exhibit 5, and also exhibit 6.

Commissioner Walker. They will be received.

(Said exhibits 5 and 6, being as follows, to-wit:)

Respondent's Exhibit 5 to Testimony of R. C. Sharp

Oklahoma Natural Gas Company

November 5th, 1919—December 1st, 1919

Districts	Average rock pressure	Total open flow	Open flow which will deliver into system	Open flow not available on account insufficient rock pressure	Average rock pressure	Total open flow	Increase in total open flow	Increase in total open flow
Okmulgee-Beggs	384	138,475,910	62,726,520	26,487,750	250	89,214,050	49,261,860	.....
Mounds	323	73,968,809	32,355,208	554,400	190	33,489,708	40,479,225	.....
Morrison	198	22,802,520	.....	15,555,840	174	15,555,840	7,246,710	.....
Ingalls	302	28,766,520	15,231,080	.....	479	15,231,080	13,535,440	.....
Stroud	283	10,971,080	7,111,200	852,480	244	7,963,680	3,007,400	.....
Blackwell	264	27,544,320	25,039,320	.....	240	25,039,320	2,505,000	.....
Cushing Shamrock	320	41,658,649	31,376,849	.....	305	31,376,849	10,281,800	.....
Bristow	846	19,667,040	26,885,280	.....	703	26,885,280	.....	7,278,240
Bixby	116	37,294,888	30,485,984	.....	101	30,485,984	6,808,904	.....
Cement	170	23,078,342	3,688,320	.....	160	3,688,320	20,290,022	.....
Walters	324	28,292,508	24,113,520	.....	324	24,113,520	4,178,976	.....
Fisher	177	2,340,720	.....	1,709,912	135	1,709,912	630,808	.....
Haskell	74	17,862,720	13,882,382	.....	68	13,882,382	4,080,347	.....
Broken Arrow	253	39,833,158	18,848,068	.....	234	18,848,068	20,984,100	.....
Claremore	118	4,781,024	5,462,912	.....	160	5,462,912	.....	681,288
Eram	174	14,766,020	10,432,170	.....	153	10,432,170	4,333,920	.....
Osage	208	46,230,856	33,782,000	.....	243	33,782,000	12,457,856	.....
Tulsa	610	1,904,150	1,904,150	.....	610	1,904,150	.....	.....
Totals	283	581,161,002	345,985,804	45,109,382	233	391,146,195	199,977,027	7,959,528

RESPONDENT'S EXHIBIT C TO TESTIMONY OF R. C. SHARP

Oklahoma Natural Gas Company

December 1st, 1939—January 1st, 1940

Districts	Average rock pressure	Total open flow which will deliver into system	Open flow which will deliver into system	Open flow not available on acct. insufficient rock pressure	Average rock pressure	Total open flow which will deliver into system	
						Decrease	Increase
Okmulgee-Beggs	259	62,726,520	67,619,100	9,946,080	201		4,892,840
Mounds	190	32,935,308	28,259,988		195	4,675,320	
Morrison	114				186		
Ingalls	479	15,331,080	13,809,930		386	1,521,150	
Stroud	244	7,111,200	7,219,080		249		107,880
Blackwell	240	25,019,520	31,517,388		325		6,497,868
Cushing-Shamrock	595	33,376,849	46,441,648		292		13,064,799
Bristow	723	26,885,200	25,442,080		713	1,443,200	
Bixby	101	30,485,984	28,089,704		95	2,416,280	
Cement	109	3,688,320	3,688,320		109		
Walters	324	24,113,520	23,043,480		292	3,070,040	
Fisher	145				174		
Haskell	68	13,882,382	14,718,720		76		836,338
Broken Arrow	214	18,848,598	12,446,256		176	6,402,742	
Claremore	89	5,402,912	4,899,432		98	503,480	
Eram	153	10,432,170	10,021,430		112	410,740	
Osage	243	33,782,000	29,561,764		216	4,220,236	
Tulsa	610	1,304,150	681,150		500	1,223,000	
Totals	261	345,085,803	345,446,410	9,946,080	225	25,939,238	25,299,845
							(25,299,845)

[fol. 387] Q. I will ask you to state whether Exhibit 6, is a true and correct statement of the open flow volume available on December 1st, 1919, and also January 1st, 1920, and of the average rock pressure in each district at that time?

A. It is.

Q. Then on January 1st, 1920, you had available how much gas?

A. 345,446,410.

Q. That was practically the same amount as you had available on December 1st, 1919?

A. Yes sir.

Q. I notice, however, that on December 1st, 1919, in the Morrison field you had an open flow volume of 15,755,840 feet, with a rock pressure of 174 pounds, and what had that gone to on January 1st?

A. To 114 pounds.

Q. The rock pressure had gone down from 174 pounds to 114 pounds?

A. Yes sir.

Q. Had gas been taken out in the meantime?

A. No sir.

Q. Even without taking any gas out it had gone down?

A. Yes sir.

Q. Now during all this time from November 1st, 1919, to January 1st, 1920, were you getting all the additional gas you could get?

A. Yes sir.

Q. Bringing in new wells, wherever you could go and buy any wells wherever you could?

A. Yes sir.

Q. Was any gas available to you that you were not taking?

A. No sir.

Q. Is there any gas available to you now that you are not taking?

[fol. 388] A. No sir.

Q. Ask you to state whether or not the Oklahoma Natural Gas Company informed the Commission that it would take gas from any person that would allow you to have it, and you would pay whatever price the Commission said you ought to pay them for it?

A. That was for emergency gas.

Q. Yes, that is what I say, during that cold weather?

A. Yes sir.

Q. Now we have talked about the Hog Shooter field as having been exhausted, and the Glenn Pool as having been exhausted. Did the Oklahoma Natural ever take gas out of the Bird Creek field?

A. Yes sir.

Q. What size field was that?

A. That was before my time too, Judge.

Q. I thought you knew something of the history of it. I understand it was a large field was it not?

A. The wells had a large volume. I don't know the area of the field.

Q. They built a compressor station there known as the Bird Creek Station didn't they?

A. Yes sir.

Q. Has that field been absolutely exhausted?

A. Yes sir.

Q. And so exhausted you have even moved your compressor station away. No longer even any low pressure gas there? Is that correct?

A. Yes sir.

Q. Now coming down to your own time, I believe you stated in the year 1917 you built a pipe line into the Morrison field?

[fol. 389] A. Yes sir.

Q. And it had a rock pressure of 800 pounds?

A. Yes sir.

Q. And what did you say was the Open Flow volume?

A. 90 million feet.

Q. You completed that line in the winter of 1917?

A. December 22nd, 1917, if I remember correctly.

Q. How much did it cost to build that line?

A. $826,000.00.

Q. Do you know what other expenditures the Oklahoma Natural Gas Company made that year. In new lines in addition to that one to the Morrison field?

A. I cannot give you the figures off hand.

Q. If you will, give me the total expenditures of the Oklahoma Natural made in that year in building new lines?

A. The total expenditures in 1917, in new lines was $974,473.09.

Q. I wish you would tell me whether that expenditure was made out of money that you earned that year or whether it was new money that was put into the building of lines?

A. It was by notes that the Board of Directors endorsed.

Q. But they were subsequently paid out of the earnings, or how?

A. They were paid by new money.

Q. How was that money subsequently raised?

A. By the sale of stock to stockholders.

Q. As against that expenditure of $974,000 in 1917, in putting in new lines, what was the net income of the Oklahoma Natural over and above its operating expenses?

A. The net income was $78,767.58.

Q. When you say net income over and above operating expenses you don't consider that nine hundred and seventy four thousand dollars in new lines as an operating expense do you?

[fol. 390] A. No sir, that is investment.

Q. So this money spent in new lines did not come out of the net income?

A. No sir.

Q. Or the gross income, either?

A. No sir.

Q. All right. Now what was that $974,000 spent in new lines for, in 1917. What was the purpose?

A. To get an additional supply.

Q. To get an additional supply of gas?

A. Yes sir.

Q Now did the Oklahoma Natural Gas Company spend any money in 1918 in an effort to procure and furnish an adequate supply of gas?

A Yes sir.

Q Where did they propose to get the main portion of that additional supply?

A At Cement.

Q Where is Cement, with respect to Oklahoma City.

A South, or Southwest.

Q How far?

A Our line was 57 miles long.

Q As I understand, you built a line from Oklahoma City to Cement, 57 miles long?

A Yes sir.

Q Did you get any gas at Cement, any adequate supply? First tell us all about what you did about getting the gas there, what the prospects were and what developments had been made?

A There had been two wells drilled there, one by the Fortuna Oil Company, and another well by what is known now as the Gordon Trust Company, which tested approximately 25 million feet each. [fol. 391] Q So those two wells made an Open Flow of about 50 million feet of gas?

A Yes sir, with a rock pressure of between seven and eight hundred pounds.

Q That gave every promise then of a large gas field with a large open flow volume and a large rock pressure?

A Yes sir.

Q Now could anybody tell how long that gas was going to last until someone put in a pipe line and went to using it?

A No sir.

Q Ask you to state whether the Oklahoma Natural believed that was a large field and would furnish a large supply of gas?

A Yes sir.

Q What arrangement did the Oklahoma Natural make to get gas in the Cement field?

A We took up 1080 acres of territory of our own, and made an agreement covering the gas rights with the Gordon Trust Company for approximately 5,080 acres more, and also had the promise through Mr. Crockett, of the Fortuna Oil Company for their entire acreage.

Q That is to say the Fortuna and the Gordon Trust Company were to drill wells and sell you the gas?

A Yes sir.

Q On the face of that you built a pipe line from Oklahoma City to Cement, 57 miles long?

A Yes sir.

Q How much did it cost you to build that pipe line?

A Approximately a million and a quarter dollars.

Q In addition to building that pipe line to Cement at a cost of one and a quarter million dollars, did you build any other lines that year, in 1918?

[fol. 392] A. We built a line from our Morrison line, below Stillwater to Ingalls, nine miles of eight inch.

Q. Was Ingalls a new gas field that had been opened up there?

A. Yes, the Fortuna had two wells with 20 million feet each, with 1,100 pounds rock pressure.

Q. Did you build any other lines that year?

A. We built approximately 27 miles of line into the Osage, 17 miles of eight inch and the balance five inch.

Q. You were going to get gas in the Osage under contract with the Secretary of the Interior, were you?

A. Yes sir.

Q. Did you build any other lines that year?

A. We built a line in the Beggs district of approximately nine miles of 8 inch.

Q. You contracted for gas in the Beggs district too, did you?

A. Yes sir.

Q. Was that a new development of gas?

A. It was merely an extension of the line we already had in there.

Q. Did you build any others?

A. We built approximately ten miles in the Haskell section to a place known as Eram.

Q. Was that a new field developed?

A. Yes sir.

Q. You contracted for that gas?

A. Yes sir.

Q. Did you build any others?

A. I cannot remember, Judge.

Q. Can you remember how many miles of line you built altogether?

A. In 1918?

Q. Yes.

[fol. 393] A. 148.56 miles.

Q. A little more than one hundred and forty eight miles?

A. Yes sir.

Q. That was large and small lines together?

A. Yes sir.

Q. What was the total expenditure of the Oklahoma Natural Gas Company in building new pipe lines in an effort to supply and furnish an adequate supply of gas in 1918?

A. $1,632,004.72.

Q. Was that paid for out of the earnings of the Oklahoma Natural Gas Company?

A. No sir.

Q. How was that money raised?

A. From the sale of stock.

Q. That was new money that was put into it?

A. Yes sir.

Q. Having spent $1,632,004.72 in 1918 in new money in endeavoring to procure and furnish an adequate supply of gas, state what your net income was, over and above your operating expenses?

A Our net income was $1,225,773.52

Q And when you say net income, you don't deduct that expenditure of $1,632,091.72 from your earnings?

A No sir, and that was before any amortization or depreciation.

Q You did not consider Amortization or Depreciation in determining that net income?

A No sir, only vouchers.

Q In other words, that was figuring your gross income, and then deducting your operating expenses?

A Yes sir.

Q So that year you spent Four Hundred Thousand Dollars more than your net income?

[fol. 394] A Yes sir, four hundred and ten or eleven thousand.

Q You built that line to the Cement field that cost one and a quarter million dollars. Did the Oklahoma Natural Gas Company build that line in good faith, expecting to get a supply of gas there?

A The Cement field was the most promising of any section that we could get to at that time and then we expected gas to be developed along the line and it was our intention at that time to extend the line on South.

Q At the time you built the line there you had two wells each making 25 million feet each, and with a rock pressure of about eleven hundred pounds?

A No, the rock pressure was between seven and eight hundred.

Q You built the line and connected up with those two wells?

A With one well.

Q What was the result?

A The Fortuna well was practically exhausted before we got our line in. Enough exhausted so that it only furnished enough gas for about three drilling wells. The other well, known as the Wade well, tested something like 12,000,000 feet at the time we got our line completed. It had dissipated itself over fifty per cent.

Q How long did it take you to complete that line?

A I think about three months, possibly a little longer.

Q Has the quantity of gas that you have been able to get in the Cement field been a worth while factor in your supply?

A No sir.

Q Is it possible it will be yet?

A We still have hopes of it.

Q About how many miles of pipe line did the Oklahoma Natural build in 1919, in an effort to secure and furnish an adequate supply of gas?

[fol. 395] A Approximately 83 miles—82.89 to be exact.

Q What was the size of the main portion of that line?

A 25 miles was sixteen inch, and 15 miles of twelve inch.

Q And that went where?

A Into the Walters field.

Q Is that the South line——

A Yes sir——

Q South of Cement?

A Yes sir, and about nine miles—no, eleven miles of 8 inch.

Q. Where was that?

A. Nine miles of that was in the Walters field.

Q. In addition to extending your line in 1919 from Cement to Walters, which was a distance of about how far,—about fifty miles?

A. About fifty-nine miles.

Q. The entire line?

A. Yes sir.

Q. Did you build any other pipe line in the year 1919?

A. We built about five miles of 6 inch, approximately two miles of 5 inch, seven and a half miles of 4 inch, two miles of $3\frac{1}{2}$ inch, three quarters of a mile of $3\frac{1}{4}$, three miles of 3 inch, and approximately two miles of 2 inch.

Q. What was the total expenditures of the Oklahoma Natural Gas Company in the year 1919 in the construction of additional pipe lines in an endeavor to procure and furnish an adequate supply of gas?

A. $1,419,667.39.

Q. In addition to that did the Oklahoma Natural expend any further sum in building compressor stations?

A. Yes sir.

Q. How much?

A. $60,000.00 approximately. We do not have the charges all [fol. 396] in on all of the stations as yet.

Q. That would make a total then of a million four hundred and seventy nine thousand and odd dollars expended in the year 1919?

A. Yes sir.

Q. In an endeavor to procure and furnish an adequate supply of gas?

A. Yes sir, we are also building at the present time and have arranged for——

Q. Just a moment, I will get to that later. What was the net income of the Oklahoma Natural Gas Company, over and above its operating expenses in the year 1919?

A. The first nine months was $755,741.25.

Q. Could you estimate what it was for the year?

A. The estimate on the October, November, and December would be $587,858.08, making a total of $1,343,579.33.

Q. Now in saying that is your net income, you say that is over and above your operating expenses?

A. Yes sir.

Q. You don't charge to operating expenses the cost of pipe lines and the compressor stations?

A. No sir.

Q. That was new money?

A. Yes sir.

Q. So the money you expended in 1919 in an endeavor to procure and furnish an adequate supply of gas exceeded your income by several thousand dollars?

A. Yes sir.

Q. If I have correctly added your figures, the money the Oklahoma Natural has spent in the last three years is an endeavor to pro-

[fol 397] cute and furnish an adequate supply of gas is $1,[illegible],145.20. Have you figured it to see if that is correct?

A I have not.

Q Also, if I have correctly added your figures, the net income of the Oklahoma Natural during the same period of time is $2,648,120.43?

A That is approximately correct.

Q Making an expenditure in the endeavor to procure and furnish an adequate supply of gas of $1,438,024.77 more than the net earnings of the Company were during that same period of time, is that correct?

A Yes sir.

Q And those expenditures which you have made were not made out of earnings, you say, but was new money furnished by your stockholders.

A Yes sir.

Q And was not charged over as operating, or maintenance costs but became a new investment?

A Yes sir.

Q Now in addition to the new money that was put in, in extending the lines, did the Company also put in any new money in its distribution plants anywhere?

A Yes sir, in all of our towns, but the larger percentage of it was in Tulsa.

Q You have not the figures on that?

A No, I have not. I would estimate that at between two and three hundred thousand dollars.

Q Inasmuch as that does not affect Oklahoma City, we will leave that out of consideration. These extensions of your lines, the main extensions of your lines that we have just discussed, namely, the line to the Morrison field in 1917, the line to the Cement field in [fol 398] 1918, and the line to the Walters field in 1919, all were used chiefly in supplying Oklahoma City with gas, were they not?

A Yes, sir, with the addition of the line to Ingalls, and the line that was built to Shamrock from Ingalls, and the Boggs line also, and they would affect the other towns accordingly, in so far as Oklahoma City was not supplied from that field there would be that much more of the original supply left for the other towns. If we could furnish a larger percentage of gas west of Kelleyville for Oklahoma City, we could furnish more gas for Tulsa from Kelleyville East.

Q What made the Oklahoma Natural think they could get plenty of gas in the Walters field?

A Well the large volume of gas that was in there and the territory covered. We made a contract with the National Oil and Development Company, and the Continental Oil Company for 20,000 acres covering all the gas rights. At that time they had one well of twenty million feet approximately.

Q What was the rock pressure?

A If I remember correctly, 800 pounds. Not less than seven-

Q. Had there been considerable development in that neighborhood by Mr. Keys and other people in regard to gas?

A. Yes.

Q. Did the Oklahoma Natural believe, in good faith, that there was plenty of gas there, and that they could get it by building a pipe line there?

A. Yes. We also made a contract with the American Producing & Refining Company for all their gas, and at that time they had three wells, and they as well as the National and the Continental [fol. 399] agreed to drill all the gas we could use as soon as we could complete our line in there. We also expected to have gas, and do yet, developed along that line.

Q. Now you built that line, expended your money and built the line, did you connect with the wells?

A. Yes sir.

Q. What was the result?

A. Well the wells have gone down so that we are only getting about three million feet a day.

Q. Out of that field?

A. Yes sir.

Q. Those wells that you connected with were over towards the Eastern part of their acreage, were they not, close to some acreage that the Lone Star Gas Company had been taking gas from?

A. Yes sir.

Q. It was learned that the Lone Star Gas Company had been taking for a good while, the total open flow volume of the wells, and in a trial before this Commission they were found guilty, and were fined for doing that. Do you consider that the fact that the wells which have been so far drilled in the Walters field, and to which you have connected, were in close proximity to that portion of the field from which the Lone Star had been taking the total open flow, do you consider that would in any way affect the wells from which you were getting gas?

A. I think it would affect the field in general.

Q. Has the Oklahoma Natural been diligent in trying to get the persons who have contracted their gas to it in the Walter field, to drill and furnish them with additional gas?

A. Yes sir.

Q. Have you been able to get them to do it?

[fol. 400] A. No sir.

Q. You have no drilling rights there as I understand it?

A. No sir, and we could not get them. We tried to have a clause put in our contract whereby we would have the privilege to drill, and reimburse ourselves out of the product, but they would not allow that clause to be inserted in the contract.

Q. In these exhibits 5, and 6, where you show the total amount of gas that is available to you, ask you to state to the Commission whether or not the Oklahoma Natural — has been furnishing all the gas which it is permitted to take from all of these wells, and from all of this open flow that is available to you?

A. Yes sir.

Q During all of these periods?

A Yes sir.

Q The Oklahoma Natural Gas Company also gets gas from the Osage?

A Yes sir.

Q How many dry wells did they drill there?

A I could not give you the exact amount. It is approximately thirty. I believe we drilled seventeen straight.

Q In an effort to procure and furnish an adequate supply of gas?

A Yes sir, and in January, 1919, we had 65 million feet of Open Flow in the Osage, and within sixty days it had dropped to 30 million.

Q You had a contract with the Secretary of the Interior for the gas in the Osage, and you say you drilled seventeen dry holes at one stretch?

A Yes sir, and more since that time.

Q And your contract was that you had to pay for gas whether you got it or not?

[fol 401] A Yes, we have to pay a minimum per day whether we get gas or not.

Q Ask you to state whether or not during the last year the Oklahoma Natural has been drilling all of its own acreage where it had drills and could get drillers and men to do it?

A Yes sir.

Q Now in giving your net income for the year 1919 at $1,343,544.33, ask you to state whether or not that takes into account whether or not there has been any deduction from your gross earnings in arriving at that amount, for any depreciation of your property at all?

A There has not been any deduction taken for that, nor has there been any deduction for dividends, amortization or depreciation.

Q Has anything been taken from it for depletion?

A No sir.

Q Every time you sell a foot of gas you are disposing of that much of your property?

A Yes sir.

Q And yet no account of depletion has been taken into consideration?

A No sir.

Q Ask you whether there has been any agreement with the Commission as to the amount of return that shall be allowed, and for depreciation and amortization which the Company may be allowed by law?

A Yes sir.

Q What is that?

A Ten per cent for dividends, and ten per cent to cover amortization and depreciation.

Q Upon the basis of your capital stock issued, then you have not even earned during the year ten per cent to cover your amortiza-

[fol 402] tion and depreciation?

A No sir.

Q That itself would be basing it upon merely the amount of your capital stock and not the value of the property used and useful in rendering service. The depreciation and amortization would amount to $1,430,000.00?

A On the capital stock and not on the value of the property.

Q And if that property was worth twenty million, then the amount to be allowed for depreciation and amortization would be two million dollars?

A Yes sir.

Q So if you set aside the proper amount for amortization and depreciation and based it upon the actual stock issued you would show a deficit?

A Yes sir.

Commissioner Walker: With reference to that ten per cent, was that an order of the Commission?

Mr Richardson: No sir, that was a conference.

A However, Mr. Chairman, we have not made enough any way. We are only paying eight per cent, but have promised to pay it, and if we ever get any more money we will have to live up to our promise.

Mr. Richardson: Ask you to state what extensions you have made in the latter part of the winter of 1919, and since the first of January, 1920, and what you are now making?

A We are building approximately ten miles, connecting Morrison over to Ingalls and Shamrock with the Shamrock station, with an eight inch line.

Q How much will that cost you?

A I should say from a hundred to a hundred and twenty five thousand dollars.

[fol. 403] Q State what the purpose of that ten miles is?

A To put the low pressure gas from the Morrison field into the Shamrock compressor station so we can utilize that low-pressure gas.

Q That is for this fifteen million of low pressure which is so low that it will not enter your pipe line?

A Yes sir.

Q All right, go ahead.

A We have let the contract and the pipe is on the way for nine miles of ten inch from Beggs to our Bixby station in order to help out Muskogee.

Q Is that to take some of this low pressure gas in the Beggs field that is too weak to enter into the lines?

A Yes sir.

Q How many miles of that line?

A Nine miles, and a fraction over.

Q How much will that cost?

A It will cost $150,000.00.

Q All right, go ahead?

A We are laying—that is we have the pipe purchased and on the way to Claremore to lay between six and seven miles of five inch to some gas we have got there.

Q How much will that line cost you?

A About $40,000.00.

Q Go ahead.

A Possibly more than that. The material part will cost approximately $40,000.00 and we have got the stringing of the pipe and the contract for laying it besides. It will make it nearer $60,000.00.

Q All right, what else? Is there any near Tulsa?

A We are laying some line up in the Osage.

[fol. 404] Q How much will that be?

A I cannot give you an exact amount on that. We expect to lay, and have the pipe on the way if the railroads will ever deliver it, and we have been after the Commission to help us on that, we expect to lay approximately three miles of eight inch, and about three miles of five inch to extend the Broken Arrow line.

Q Has the Oklahoma Natural Gas Company any unpaid bills outstanding at this time?

A In excess of our cash we have about $500,000.00, of unpaid bills.

Q For making extensions and material?

A Yes, new lines.

Q What amount of cash have you in the banks?

A I should say less than $100,000.00, Judge.

Q And you say that you have unpaid bills amounting to five hundred thousand dollars more than your cash?

A Yes, we figure our unpaid bills amount to about six hundred thousand dollars, which was about five hundred thousand in excess of our cash.

Q Have you any means of paying those bills?

A The only means we will have of paying them is if we get earnings enough this winter to take care of our July and October dividends as we cannot earn those dividends in the summer time. In fact the summer months, as a rule our operating expenses and gas purchased exceeds our gross earnings. We have to practically earn our entire year's dividends in the winter months.

Q In order to make all of these extensions, you have had to go back to your stockholders for new money?

A Yes sir, we have.

Q And if you make any considerable extensions in the next year [fol. 405] you will probably have to do the same thing?

A Yes, and if we use the money that we get this winter to pay bills with, we will have to go back to the stockholders to pay dividends.

Q You paid them a quarterly dividend of two per cent?

A Yes sir.

Q If you should not pay that dividend, would you be able to raise any money with which to make any new extensions?

A No sir.

Q What has been the effect of the agitation in regard to rebating the bills, had upon the consumers paying their bills?

A We had a large amount of consumers in our Tulsa office, which is the only one I am familiar with, that would not pay their bills

until we promised them if any rebate was finally agreed to that we would take care of them.

Q. What percentage of your consumers, would you say, have paid their bills?

A. I could not say. Mr. Owen told me that about forty per cent of theirs were held up, but I should say about 75% of ours have been paid. They paid them, however, with the understanding that they would be rebated in case anybody else was.

Q. But even with that portion of the collections made, your cash in bank is five hundred thousand dollars less than your unpaid bills?

A. Yes sir.

Q. Now if you were going to spend three hundred thousand dollars in making new extensions, and the cost of extensions you already have made and unpaid bills amounts to half a million of dollars more than your cash on hand, when, and how are you going to get this additional investment back?

A. We made those expenditures thinking after they were made [fol. 406] we would be in pretty good shape for a couple of years and that the earnings would pay it back, but the disappointments which we have had in the fields that we built the lines to has entirely changed around the plans that we had expected to work out. One thing, we find you cannot wait until you see whether a field will hold out or last before you lay a line to it, for if you did you would not lay it.

Q. Some one has to lay a line there before you can find out how long it will last, do you?

A. Yes sir.

Q. Now you don't furnish any industrial consumer with gas for industrial consumption during the winter time?

A. We have not had any so far as our plant was concerned. We did not have an Industrial consumer on in November and December, and have not yet. We were advised possibly thirty days ago that a mill at a place by the name of Hunter was on, but it was without our knowledge, and the minute we knew of it we got busy and cut them off.

Q. You don't furnish gas for any glass plant or smelter at any time, do you?

A. No sir.

Q. And such industrial consumers as you do furnish is only in the summer or when gas is available?

A. Yes sir, we have refused to take them on, even in mild days, preferring to let our wells rest up for the peak load days.

Q. Mr. Sharp, do you know of anything the Oklahoma Natural could have done by which it could have procured more gas than it has procured and furnished and which it has omitted to do?

A. No sir.

[fol. 407] Q. I presume that the increase of wages of your employees, increase in the cost of pipe, and drilling, and everything of that kind has kept pace with the general increases that have prevailed over the country in other matters and things?

A. I should imagine it has exceeded that in many ways.

Q If your present supply of gas is inadequate, even in order to keep the supply where it is, are you going to have to make new extensions each year?

A We should, but I don't think we will be in shape to do it.

Q I say, if you keep the supply where it is now, would it be necessary to do that?

A Yes sir.

Q How many stockholders has the Oklahoma Natural Gas Company?

A Between 1,900 and 2,000.

Q They are scattered all over the United States?

A Yes sir, we have stockholders running from one share up to larger amounts.

Q Do you have any trouble in contracting with persons for gas, that is, trying to buy gas from them because they insist on your agreeing to take the full 25% of the open flow even in the summer time?

A Yes sir.

Q State to the Commission what that trouble is that you have experienced?

A In the summer time we cannot possibly average more than five or ten per cent.

Q Now wait a minute, and let me see if I understand you. You mean in the summer when people are not heating their homes, that the consumption of gas is such that you cannot take more than five to ten per cent from each well with which you are connected. That [fol. 408] the demand for gas is not large enough to enable you to do that?

A That may be a little too low, Judge. It would run about fifty per cent of what we could take in the winter months, say 10 to 12 per cent.

Q That is what you mean?

A Yes, and there are certain times that we cannot take that much of course. We have had called to our attention several times gas that Mr. Josey had in the Cushing field, and I have talked with Mr. Josey since I have been in Oklahoma City this last time. He was in my office some two weeks ago. We had the matter up with him in December, and he stated his contract was up with the gas company he was selling his gas to on January 1st, but that he would prefer to do business with the other people, on account, not of the price, but on account of the fact that they would take 25% of his gas the year around.

Q Did he offer to sell you his gas if you would agree to take 25% the year around?

A He said his contract would run out March 1st, and he would be glad to take the matter up with us, but not unless we would agree to take 25% of the maximum.

Q Can you agree to take 25% the full year?

A No sir.

Q Why?

A We have to pro rate the gas in all the fields, and as we are

buying and purchasing gas in that same section, the amount that we would take from Mr. Josey would be more than we could take from all of the producers in that section.

Q. In order to clarify the matter, the legislature of Oklahoma passed a law making natural gas pipe lines common purchasers and required them to take from each producer in the field in the same [fol. 409] proportion they would take from other producers, is that it?

A. That is my understanding.

Q. And to treat their own production in the same way?

A. That is my understanding.

Q. Therefore, if you should take the full 25% of the open flow of Mr. Josey's wells, you could not take that percentage of someone else's wells in the summer time, is that it?

A. Yes sir.

Q. So, under the law, you are not permitted to make that contract?

A. No sir. Judge, in the summer time we practically keep our own wells shut down in order to take a larger percentage from the producers.

Q. And even then you cannot take the full 25%?

A. No sir.

Q. I have before me a letter written upon the letterhead of the Bessemer Oil Corporation, Palace Building, Tulsa, Oklahoma, dated December 3, 1919, addressed to N. S. Sherman Iron Works, Oklahoma City, Oklahoma, and signed by C. E. Stalkner, in which he says that his company had some gas in the Broken Arrow district twenty miles from Tulsa, and that he undertook to sell it to the Oklahoma Natural Gas Company, and he says this:

"The gas we refer to as being shut in is only one of many good gas wells throughout this district that have no market. The Oklahoma Natural Gas Company, and the Kansas Natural Gas Company flirted with us during the summer of 1919 about contracting for this gas. We agreed on a price of 6½ cents, but when it came to the question of some guarantee from them as to the amount of gas they would take daily, they wanted that clause eliminated and stated they would have to depend on their ability to take what gas they could."

Did Mr. Stalkner insist that you should take the full 25% from his well?

[fol. 410] A. That came up in the fall of 1918 when it was awfully hard to get pipe. I know the record of the Broken Arrow gas, and in order to—we first thought we could not get the line at all, could not get the pipe. We afterwards found we could get the pipe, and we did get the pipe, which we purchased, we purchased 8 inch pipe at $1.50 a foot, or $1.49 to be exact. I purchased the pipe myself, f. o. b. South Chester.

Q. Pennsylvania?

A. Yes,—we had a combined volume there of approximately forty million feet. We advised our Mr. Cole, who looks after the making of the gas contracts, that of he could get all the purchasers out there

to sign up, that we would put the line in, only figuring at that time that we could possibly get the money back by re-claiming the line, which of course was bad business.

Q. You mean by that you would only get gas enough out of the field to pay for the laying and reclaiming of the line, without any profit?

A. That was our judgment on the field. While the pipe was in transmit, our Mr. Grubb tested the wells thirty days later, and they had dissipated themselves from over forty million down to twenty-one million.

Q. Do you know whether they had blown all that away, or were they shut in?

A. They were shut in, but still dissipated themselves. They had not blown any of it away. So we needed that pipe. We could connect up possibly 75 or 80 million in the Beggs field, and we used part of that pipe that was intended to be used at Broken Arrow in the Beggs field, and a part of it was used at Cement, but I might also state that at no time would the producers sign up. This summer they took the matter up with us and promised to do additional [fol. 411] drilling. Mr. Burnell was one of the gentlemen who came to see me about it, and he stated he would rather sell us the gas if we would go ahead and build the line, putting these wells on the direct suction of the Braden station. At the same time they got hold of the Kansas Natural who had a line within a mile and a half of these wells and they traded back and forth. We offered to put the line in on a six cent basis, and they finally made a contract with the Kansas Natural at 6½ cents, and the Kansas Natural had an understanding with them, so I am advised—this is all hear-say with me—I was told by the Kansas Natural people, that they would only be able to take a certain amount of that gas as they would not have them on direct suction and just so long as the wells would have rock pressure enough to deliver into the Kansas Natural's lines they would take gas. Evidently from that letter the Kansas Natural would not agree to take 25% of the Open Flow of the wells after the rock pressure should go down.

Q. The point I was making is, under that law you could not obligate yourselves to take 25% of their wells if you could not use 25% of the open flow of everybody else's wells. You have to prorate that, and if that was made a condition of the contract, you would be prohibited by law from entering into that contract?

A. Yes sir, and good business judgment would not permit making it either.

Q. You are taking gas from the Broken Arrow field?

A. Yes sir, we connected up. We laid a six inch line over there from our 12 inch line, and connected up with Mr. Johnson, and some others, that were making 21 million feet sixty days ago, and the test on January 1st was nine million, and I am not sure but that there was an additional well put on in the meantime. The Broken [fol. 412] Arrow field has always had a reputation of not holding up.

Q. Mr. Sharp, does the Oklahoma Natural pump any air into its lines?

A. No sir.

Q. Has it ever done so?

A. No sir, and we have refused on one or two occasions to purchase stripped gas from compressor stations because such gas would contain from eight to forty per cent air and we did not wish to take the chances of blowing up our lines or injurying the help or anyone else and did not wish to have any air in our lines.

Q. How many consumers did you have on December 31, 1918?

A. May I start with 1917?

Q. Yes?

A. December 31, 1917, we had 47,984 domestic consumers——

Q. Now wait a minute right there. Was that all consumers you served directly, or indirectly?

A. That is on our entire system. Not only own distributing plants, but any other distributing plants connected with our system.

Q. I see. Go ahead.

A. (continued) December 31st, 1918, we had 53,945 and on December 31st, 1919, we had 59,140.

Q. Now these were consumers that were represented by increases in the population of the towns served by them?

A. Yes sir.

Commissioner Walker: That is 11,000 gain in 2 years?

A. That is the towns of Noble and Kiefer were not considered.

Q. These were taken on because of the obligation of the distribut-[fol. 413] ing company to serve all of the inhabitants of the town.

Commissioner Walker: Have you the figures that shows the difference in the amount of gas used in 1917, and what you have now. The amount you had then and what you have now?

A. No sir, I have not the figures for 1917.

Commissioner Walker: What was it for 1918?

A. I don't have that either. I have it for November, December and—no, December 1st, 1919, and January 1, 1920.

Q. Mr. Sharp, natural gas is a commodity that nature supplies and it is not something that you can make as I understand it?

A. Yes sir.

Q. And what do you say to the Commission with respect to the supply of gas available to the Oklahoma Natural. Is it increasing or decreasing?

A. Decreasing. The consumers are increasing and the supply is diminishing.

Q. And notwithstanding the fact that your investments from year to year in an effort to acquire gas exceeds your net income for the years, you still are not able to get enough gas to supply the public?

A. No sir.

Q. Is that your fault?

A. No sir.

Q Do you say to the Commission that the Oklahoma Natural has put forth every effort possible in the expenditure of money in the search for gas and the effort to procure and furnish it that any reasonable person in the same business would put forth in order to procure and furnish a reasonable and adequate supply of gas?

A Yes sir.

Q And notwithstanding that, in periods of extreme cold weather [fol. 414] there has been and must be an inadequate supply instead of giving to each customer all the gas he wants?

A Yes sir, and that same condition prevails every place where they try to heat their homes with gas in zero weather.

Q As I understand you, the Oklahoma Natural operates at a deficit in the summer time?

A Yes sir.

Q If they make any money at all they must make it in the winter time when people are heating their homes, and not for cooking purposes only?

A Yes sir.

Q What would be the effect of requiring you to discount your bills for low pressure in the winter time, upon your ability to continue in operation?

A We could not do it.

Q Is there any matter that you think of that I have omitted to ask you about?

A I think these earnings, Judge, show that we are not earning our dividends, let alone the amortization and depreciation.

Commissioner Walker. What do your earnings show?

A For the year of 1919, our net earnings were $1,243,500.21, which would be about nine per cent on the outstanding capital stock. Without any amortization or depreciation.

Q Or depletion?

A Or depletion.

Q You have a copy of your entire statement?

A Yes sir.

Mr. Richardson. If the Commission or Mr. Fulton desire to see this, or to interrogate the witness we will be glad to submit it.

Commissioner Walker. It is on file with the Engineering Department.

[fol. 415] Commissioner Russell. What time does that figure for 1919, cover?

A Our fiscal year happens to be from March 1st to March 1st, but for the Federal Income Tax we changed it to make it for the calendar year.

Q Then that is for the calendar year of 1919?

A Yes sir.

Commissioner Russell. How do you reckon these unpaid gas bills? How are they counted? If you had those November and December bills collected it would make a better showing wouldn't it?

Mr. Richardson. He said he had the nine months exact and the other three months were estimated.

Commissioner Russell: What was that exact amount?

A. For the nine months it is $755,741.25, and the estimated earnings for October, November, and December were $587,858.08, but those were good months in 1919. They were the coldest November and December in 29 years.

Commissioner Walker: They are your heaviest months, anyway are they not?

A. Ordinarily January and February are about as heavy.

Commissioner Russell: When did the present rate take effect?

A. September 1st, but it practically went into effect October 1st. September 1st the rate was changed.

Commissioner Russell: So this rate does not apply to the months you have got there?

A. It applies to the estimated months, but not to the others.

Commissioner Russell: Have you your gross income for that time? What is the gross, and what is your ratio of operating expenses. Your operating ratio. Do you have that?

A. I have not the gross for those three months.

[fol. 416] Commissioner Russell: Have you the gross for the year?

A. I have the gross for the year.

Commissioner Russell: Including your estimate for those three months, what was it?

A. I will have to back up on that Senator, I don't have the gross here.

Commissioner Russell: Nor have you your operating ratio?

A. No sir.

Mr. Richardson: I will ask you if that is not on file with the Commission?

A. It always is, but it has not yet been filed. I can furnish it by tomorrow or the next day.

Commissioner Russell: What I wanted to determine was what the income had been, and what your net income would be if the rate now in effect were applied during the year.

A. I can have those figures for you Senator in two or three days at the outside.

Mr. Richardson: That is all.

Mr. Fulton: No questions.

Commissioner Walker: Call your next witness.

Mr. Richardson: We rest, if the Commission please.

(Thereupon no further evidence was offered on behalf of the respondent, and the cause was submitted to the Commission, after oral argument by Judge Richardson.)

[fols. 417 & 418] The above and foregoing is a true, correct and complete transcript of the entire proceeding had before the Corporation Commission of the State of Oklahoma in the above entitled and numbered cause, and is all the evidence introduced before said Commission in said cause.

[fols. 419-427] BEFORE CORPORATION COMMISSION OF OKLAHOMA

[Title omitted]

FINDINGS OF FACT AND ORDER OF THE CORPORATION COMMISSION—June 7, 1920

This matter comes on now upon the hearing of respondent, the Oklahoma Natural Gas Company's response and petition to set aside Order No. 1610 promulgated by this Commission on January 10, 1920, which order, in words and figures, is as follows, to-wit:

"BEFORE THE CORPORATION COMMISSION OF OKLAHOMA

Cause No. 3846. Order No. 1610

"In the Matter of Interpreting Charts and Determining Discounts on Bills for Gas Furnished by the Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company in Oklahoma City in Accordance with Commission's Orders No. 1374 and 1599 and Journal Entry, Cause No. 3830.

"Findings of fact and order of Commission omitted, printed side page 23 ante.

[fol. 428] This order was served upon the Oklahoma Natural Gas Company and the Oklahoma Gas & Electric Co. and said respondents were notified that the 26th day of January, 1920, had been set as a date at which the Corporation Commission at its Court Room at the Capitol Building, Oklahoma City, Oklahoma, would hear any testimony which they had to present as to why said order should not be put into force and effect with reference to gas furnished by them to their customers in the city of Oklahoma City, Oklahoma.

On January 26th, the Oklahoma Natural Gas Company, on behalf of itself and the Oklahoma Gas & Electric Company, filed a response and a protest to the Proposed Order of the Commission in which they object and protest against said order, and petition the Commission to set same aside upon the following grounds for the following reasons, to wit:

1. That the gas furnished and distributed in the city of Oklahoma City, Oklahoma, is the property of this respondent who buys a portion thereof and produces the remainder thereof and transports the same to said city where it is distributed by the Oklahoma Gas & Electric Company agent of this respondent under a contract by which said Oklahoma Gas & Electric Company receives a percentage of the collections made from the sale of said gas.

2. That the order for discount or rebate of the bills for gas during the months November and December, 1919, as provided in Order

No. 1610, is void and of no effect for the reason that same violates Section 18, Art. 9 of the Constitution of Oklahoma with reference to notice to respondent.

3. For the reason that said order is in violation of Section 7 and the Bill of Rights of the Constitution of Oklahoma providing that no person shall be deprived of property without due process of law, and of the Sections 23 and 24 of the Bill of Rights of the Constitution providing that private property shall not be taken for either private or public use without just compensation.

[fol 429] 4. That the orders of the Commission dated December 30, 1919, and January 10, 1920, providing for the rebating and discounting of gas bills for low pressure during the month of December, 1919, are arbitrary, unreasonable and violative of the 14th Amendment to the Constitution of the United States.

That thereafter on January 26th, 27th, and 28th testimony was introduced by the Oklahoma Natural Gas Company on behalf of itself and the Oklahoma Gas & Electric Company and arguments were made by the attorney for respondents and the case closed.

To respondent's first contention that the gas furnished and distributed in the City of Oklahoma City is the gas of the Oklahoma Natural Gas Company and that the Oklahoma Gas & Electric Company by virtue of a contract is the agent of the Oklahoma Natural Gas Company in the distribution of gas and the collection of proceeds, the Commission finds to be correct.

With reference to respondent's second objection that said order is violative of Section 18, Art. 9 of the Constitution of Oklahoma, for the reason that insufficient notice of the orders of this Commission upon the question of rebates and discounts in this cause and in Causes No. 3223 and 3615, Orders No. 1610, 1374, and 1599, respectively, the Commission finds that order No. 1374, referred to in its proposed Order No. 1610 was referred to simply as outlining a basis upon which the Commission in dealing with charges for inadequate gas service, might reach a conclusion, the condition appearing to the Commission similar.

The Commission finds that in its proposed order No. 1610, it directed respondent's attention to its Order of November 6, 1919, made in Cause No. 3615 in which the Commission required all gas distributing companies distributing gas in the State of Oklahoma to install recording pressure gauges at all regulator stations and at such other points on their low pressure systems as would record the pressure of gas furnished to their respective consumers. This order has been complied with by respondent companies herein and data has been furnished by said respondents, upon which the Commission has based its computation for the purpose of requiring rebates in the event that respondent companies failed to show that same were improper, incorrect or inequitable. Therefore since said companies complied with this order and furnished this data without objection, since the data furnished thereunder was not to be used except in the event that respondent companies after having been

given due notice could not show that said data was incorrect, improper or inequitable, that the companies should not be heard to say at this time that they had not received notice, since the Commission finds that they had complied with the order, thereby waiving right to additional orders; also since under the proposed order they [fol. 430] were given due notice and opportunity to answer all matters, to present testimony and make objections as to the propriety of the enforcement of any of the matters set up in Commission's proposed order.

With reference to that part of respondent's protest and response which objects to the proposed Order No. 1610 upon the ground that same is a general order and not directed against any gas company by name, the Commission finds that said Journal Entry upon which said objection is based was simply a notice to all companies distributing natural gas to domestic consumers in the State of Oklahoma to deduct from the gas bill of each domestic consumer for low pressure and outlining a formula for the adjustment of gas bills as a result of inadequate service. This Journal Entry was merely a directory and advisory and was not treated as an order in the sense that respondent treated same, and failure of the company to comply therewith has not caused the Commission to threaten them with fines. The respondents, however, with reference to this Journal Entry complied therewith for a long time and furnished the Commission with data arrived at by applying the standards prescribed in said Journal Entry to the pressure found to exist by meters installed under Order No. 1595 of this Commission.

The Commission finds further in reference to this objection that by reason of notice given as to hearing with reference to proposed order No. 1610, that respondent company was given an opportunity to introduce testimony as to any matters contained, and all orders referred to in Commission's Order No. 1610 that the Commission is not by this order attempting to enforce any orders referred to in its proposed Order No. 1610, but only referred to said orders for the purpose of appraising respondent companies in detail of all matters which it proposed to act upon after full opportunity had been given to the respondent company to offer such evidence and make such objections as it deemed proper.

The Commission referred to Order No. 1374 for the purpose of calling attention to its past policy with reference to inadequate service in cases which had been before the Commission. It referred to its Order No. 1598 in directing respondent company's attention to the basis and method which it had used in acquiring data with reference to low gas pressures. It called respondent's attention to its Journal Entry issued by it December 13, 1919, in order to apprise it of the standards which it had outlined and proposed to put in effect with reference to methods requiring rebates for varying pressures. It outlined the rebate percentage applied to the various districts in Oklahoma City in order to apprise respondent companies as to the basis upon which said rebates and refunds should be made, all of these methods being employed by the Commission for the pur-

[fols. 431 & 432] pose of furnishing respondents in detail with the methods and standards which they proposed to adopt in arriving at an equitable basis for requiring rebates for furnishing it inadequate pressure in Oklahoma City.

The Commission finds, therefore, that the objections to the orders made prior to its proposed order No. 1610 and referred to therein, have been removed and do not apply so far as these respondents are concerned by the notice given in this cause.

The Commission further finds that respondents herein have failed to show sufficient cause why said Order No. 1610 should not be put into effect.

Wherefore, it is the order of the Commission that the response of the respondents, and its petition to set aside Order No. 1610, is in all things overruled, and said order is hereby put into effect.

Done at Oklahoma City, Oklahoma, this the 7 day of June, 1920.

Corporation Commission of Oklahoma. Art L. Walker, Chairman. Campbell Russell, Commissioner. R. E. Echols, Commissioner.

Attest: P. E. Glenn, Act. Secretary.

[fols. 433 & 434] Before Corporation Commission of Oklahoma

[Title omitted]

Application for Supersedeas—Filed June 11, 1920

Now comes the Oklahoma Natural Gas Company, and shows to the Commission that it desires to appeal from the order of the Commission made in the above entitled and numbered cause on the 7th day of June, 1920, ordering the rebating of bills for natural gas during the winter of 1919-1920, and therefore requests the Commission to fix the amount of plaintiff's suspending bond, and to allow plaintiff fifteen (15) days in which to make said bond, and also requests the Commission to prepare and certify the record in this cause for said appeal to the Supreme Court of Oklahoma.

Ames, Chambers, Lowe & Richardson, Attorneys for Oklahoma Natural Gas Company.

[fol. 435] Before Corporation Commission of Oklahoma

[Title omitted]

Order Allowing Appeal—June 11, 1920

Now on this the 11th day of June, 1920, comes the Oklahoma Natural Gas Company, Order Number 1649 made herein on June 7, 1920, having been just served upon and received by said com-

pany, and said Company before the Commission duly excepts to the said Order No. 1649 made and entered in the above entitled and numbered cause, and gives notice to the Commission in open session of its intention to appeal therefrom to the Supreme Court of Oklahoma.

And it is by the Commission ordered that said exception of said Oklahoma Natural Gas Company to the making and entering of said Order Number 1649 in the above entitled cause be and the same is hereby allowed and ordered entered of record.

It is further by the Commission ordered that notice of the appeal of said Oklahoma Natural Gas Company from said order be by the Commission duly entered upon its records, its said appeal to be allowed, and that said Oklahoma Natural Gas Company be and it is hereby allowed fifteen (15) days from this date in which to make, file and cause to be approved, a suspending and supersedeas bond, [fols 436 & 437] with good and sufficient sureties in the sum of $40,000.00; and during said period of fifteen days (15) said Order Number 1649 shall be suspended, and upon the making, filing and approving of said bond the said order shall further be suspended during the pendency of said appeal.

(Signed) Art L. Walker, Chairman; R. E. Echols, Campbell Russell, Commissioners.

[fols 438 & 439] Bond on Appeal for $40,000—Approved and filed June 11, 1925; omitted in printing.

[fol. 440] Before Corporation Commission of Oklahoma

Chairman's Certificate

I, Art L. Walker, Chairman of the Corporation Commission of the State of Oklahoma, do hereby certify that the above and foregoing is a full, true, correct and complete transcript of the record in cause No. 3846, against the Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company, relating to the rebating and discounting of bills for natural gas during the winter of 1919 and 1920, including the order proposed by the Commission, the order to show cause why the same should not be put into effect, the response of the Oklahoma Natural Gas Company thereto, all evidence introduced upon the hearing thereon, the order of the Commission made on said hearing, and all subsequent proceedings had; and the same is a full, true, correct and complete case made in said cause; and as Chairman of said Corporation Commission, I hereby certify the same accordingly.

Witness my hand and the seal of said Commission on this the 11th day of June, 1920.

Art L. Walker, Chairman of the Corporation Commission of the State of Oklahoma.

Attest: P. E. Glenn, Act. Secretary. (Seal.)

[fol. 441] BEFORE CORPORATION COMMISSION OF OKLAHOMA

[Title omitted]

Additional Statement of Evidence

CAPTION

To the Honorable Supreme Court of Oklahoma:

Pursuant to the order of the Supreme Court of Oklahoma made in the cause above entitled and numbered on September 26, 1922, the Corporation Commission of Oklahoma took the additional testimony hereinafter set forth in the Corporation Commission's Court Room in the State Capitol Building on October 14, 1922; the appellants being represented by their attorneys of record, Ames, Chambers, Lowe and Richardson, and the Corporation Commission being represented by its attorney, E. S. Ratliff; which evidence so taken, and a true and correct copy of the proceedings so had, are as follows:

ARGUMENT OF COUNSEL

Commissioner Walker: All right, gentlemen; proceed.

Mr. Ratliff: Before we get started on the testimony I want to find out what the scope of this inquiry is going to be. This motion was filed in the Supreme Court on June 19, 1922, and recites, as a basis, testimony, each item of which is documentary. For instance, Mr. Wyer's bulletin put out by the Smithsonian Institution, and the franchise and the contract between the Oklahoma Gas & Electric Com-[fol. 442] pany and the Oklahoma Natural Gas Company, under which the- formerly operated; those were the matters particularly referred to in the motion; those were the matters which were particularly desired to be introduced. The Commission will remember in the former hearing of this case before this Commission, all the testimony that was introduced was introduced by the Company. Not a particle, not a scintilla of evidence was offered by any one else except the Oklahoma Natural Gas Company. Mr. Wyer testified; Mr. Hancock testified and four or five other experts from different parts of the United States appeared and testified in this case. Mr. Wyer testified and referred to the bulletin which was referred to in this motion. It wasn't introduced, as I remember; I wasn't here at the hearing, but so far as the record shows, it wasn's introduced, but in my opinion the three hundred pages of transcript in this case representing the testimony taken at that time, covered every phase are set out in this motion and which are embraced in written matter, of the situation with the possible exception of the matters which are set out in this motion and which are embraced in written matter, to-wit: the pamphlet put out by the Smithsonian Institution, the franchise of the Oklahoma Gas & Electric Company, possibly the franchise of the Oklahoma Natural Gas Company and the contract

that exists between the Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company.

Now, at this time, the Commission hasn't even got a gas engineer to sit here in this case and to cross examine or to suggest questions or suggest suitable cross examination. The gas engineer of this Commission has recently resigned and accepted employment elsewhere. The situation that confronts the Commission is this: This [fol. 443] Commission has heard this case fully and thoroughly and experts from all parts of the country have been here and bulletins have been introduced—Mr. Wyer wrote the bulletin personally, he is the man who wrote the bulletin that is to be introduced here and Mr. Hancock testified before and I want to know whether or not this is a *hehearing* on all matters or whether or not the evidence is to be restricted to matters specific upon which the Supreme Court desires to have information.

Commissioner Walker: I want to get this matter clearly in my mind. As I understand from Judge Richardson, there was an application made to the Supreme Court to get in additional testimony and the Supreme Court issued an order of what testimony to take.

Mr. Richardson: No, sir——

Commissioner Walker: How do we know the procedure?

Mr. Richardson: I know how——

Mr. Ratliff: I think the Supreme Court should be asked.

Commissioner Walker: Wait a minute. Let us get this cleared up. What the Commission wants to know is what additional testimony the Supreme Court wants here and we will have to have an order from the Supreme Court telling us.

Mr. Richardson: I filed a motion in the Supreme Court and this is the original of it and here is the prayer: (Reading) "Wherefore appellant prays that the Corporation Commission of Oklahoma be directed to take such further evidence in relation to the matters above mentioned, and other matters, which either of the parties hereto may desire to offer, and that said Commission certify the [fol. 444] same to this Court to be made a part of the record herein." The Supreme Court made this order in case No. 11,511 sustaining my motion.

Now, I will say this, however, it is not my purpose to cover anything that has already been covered in this case. In the relate case that went to the Supreme Court of the United States they made two statements and laid them down as the basis of the decision in that case. First, that the order of the Commission requiring a relate was not predicated upon an insufficiency of gas, was not predicated upon an inadequacy, upon the quantity, volume or supply of gas, but was predicated upon the failure of the company to supply the quantity it did furnish at an adequate pressure,—at a pressure required. I purpose to show here, by evidence, the relation that exists between volume and pressure, the fact that you cannot maintain the pressure unless you have the volume of gas with which to do so. That is set out in my application.

Another statement was that it appeared from the decision of the

Supreme Court of Oklahoma affirming the first order, that there were franchise or charter requirements upon the company requiring it to maintain certain pressures. The record was silent in that case respecting any charter or franchise requirements; there was something said about it in the opinion but no evidence offered on it. I purpose to show that there is no franchise or charter requirement relating to that matter, and that is all.

Commissioner Walker: I want the record to show this: That if an order is made by the Supreme Court, or anything the Supreme [fol. 445] Court wants the Commission to do in the way of taking additional evidence, the Commission wants to do that, but to reopen this case——

Mr. Richardson: I am not intending to do that at all.

Mr. Ratliff: Can't we stipulate that if the franchise is silent as to the requirements——

Mr. Richardson: All right; the franchises are here and if you want to you can read them over and then we can stipulate and that will obviate any necessity for evidence on that question.

Mr. Ratliff: I think we can simplify the matter very much on the statement of Judge Richardson. Doesn't the pamphlet which you mention in your motion here contain the testimony which Dr. Wyer will offer with respect to the relationship which exists between pressure and volume?

Mr. Richardson: The pamphlet shows the amount of gas that a compressor can put through a given line at relative amounts at relative intake pressures and I want to amplify that a little and inquire into Boyle's law and whether or not the volume of gas which is available to a company has anything to do with the pressure at which it can furnish it; just amplify that same thing and it will not be long.

Commissioner Walker: Both of you are lawyers—as I say, both of you are lawyers and you understand just what you are doing in this case. The Commission stands ready to do anything that is directed to be done by the Supreme Court. We wouldn't want to go beyond that

[fol. 446] Mr. Richardson: I wouldn't want to go beyond that even if the order of the Supreme Court was broader. I think I have got everything except what I have mentioned.

Commissioner Walker: But to re-open this case——

Mr. Ratliff (interrupting): In arguing this case before the Supreme Court, Judge Richardson and I, nothing was said about anything which was desired to be introduced at this time, as I remember, except the pamphlet and the contracts referred to.

Mr. Richardson: Oh, yes——

Mr. Ratliff (interrupting): At least it was my understanding and yet is my understanding that those were the only things which were to be offered at this time. There was a stipulation in this case in the Supreme Court. I have been unable to get my hands on it and I don't know whether it was written or otherwise, but it was stipulated in the Supreme Court and I don't know whether the Supreme Court considered that matter in this connection or not, but

after the appeal was taken a stipulation was filed in the Supreme Court in this case whereby this case was to be in the Supreme Court pending and to be determined, as I take it from the stipulation, to be determined by the decision of the case ahead of it in the Supreme Court of the United States. Now, I can't get a hold of the written stipulation and I don't know exactly what the terms of it were——

Commissioner Walker (interrupting): Do you recall the stipulation? (To Judge Richardson.)

Mr. Richardson: There never was any such stipulation. There [fol. 447] was a stipulation that this case was to be continued in the Supreme Court of Oklahoma until after the decision of the other case in the Supreme Court of the United States, it being the idea that if the Supreme Court of the United States held it was unconstitutional to require relate at all, then that would end the other case altogether, but there never was any stipulation at any time that this case should abide the decision of the other case.

Commissioner Walker: Isn't there a copy of the stipulation here?

Mr. Richardson: No; it is on file in the Supreme Court of the United States.

Mr. Ratliff: But it should be in this case, in the Supreme Court down here; it couldn't be found, however. Now, with the statement of Judge Richardson, I don't think I would object to taking the testimony suggested by him; I think it could be done speedily, but so far as the cross examination of Dr. Wyer is concerned, and these other experts, the Commission is not able or ready or willing to enter into that at this time because no gas expert or gas engineer is here for the Commission.

Commissioner Walker: All right; let the witnesses be sworn, then. (Witnesses sworn.) Call your first witness.

[fol. 448] SAMUEL S. WYER, called as a witness in behalf of the appellants herein, having been first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Your name is Samuel S. Wyer?

A. Correct. Wy-er.

Q. You are the same Mr. Wyer that has testified in this case before?

A. I am.

Q. Does there exist any relation between volume of natural gas and pressure of natural gas?

A. There is a definite relation known as Boyle's Law which is the volume varies inversely with the absolute pressure, the absolute pressure being the sum of the atmospheric pressure furnished by barometer and the ordinary pressure gauge.

Q. And inversely, then, the pressure would vary with the volume also, would it?

A. Yes sir.

Q I want to ask you this question: If a natural gas company has a supply of gas and such supply of gas as enables it to supply its consumers with a four ounce pressure, and that supply of gas becomes diminished and considerably reduced, can it continue to supply gas at a four ounce pressure?

A No.

Q In other words, does the pressure at which gas may be furnished depend upon the quantity and volume of gas available?

[fol 449] A Volume and pressure are inseparable.

Q If the quantity or gas available becomes reduced, could the company, by the use of compressors, continue to furnish gas to its consumers at a four ounce pressure?

A It could not.

Q If it could, then as the volume continued to be reduced and finally reached zero, it could still keep up the pressure, couldn't it?

A Correct; and if the matter that you suggest held, it would not be necessary to drill any gas wells at all.

Commissioner Walker: In other words, you could take gas out of a well that had no rock pressure by artificial pressure and put it through the lines, is that what you mean?

A If that theory held, that would be exactly what would happen.

Q Now, with respect to the capacity of a compressor station, does the quantity of gas available and the rock pressure of the wells have anything to do with the capacity of the compressing station?

A Yes sir, it does. As the rock pressure declines the capacity of the compressor station also declines.

Q What are the relations? What are the relative quantities?

A By way of comparison, the output of a compressing station operating against a discharge pressure of three hundred pounds gauge will decline as follows for the respective intake pressures——

[fol 450] Q (Interrupting.) Now, pardon me a moment before you proceed further. By intake pressure you mean the pressure with which the gas is put into the compressor, don't you?

A By the natural rock pressure of the well, yes sir.

Q All right; go ahead.

A When the rock pressure is such that it gives an intake pressure of 150 pounds, the compressor capacity is taken at thirty million cubic feet of gas for twenty-four hours. If the pressure delivered to the compressor drops to 100 pounds, then the thirty million shrinks to twenty million; if the pressure drops to seventy-five pounds, then the thirty million shrinks to fifteen million; if the pressure drops to fifty pounds, the the thirty million shrinks to ten million; if the pressure drops to thirty pounds, then the thirty million shrinks to six million; if the intake pressure drops to twenty pounds, then the thirty million shrinks to four million.

Q Now, from what document are you taking that data? What is that document?

A Page 29 of Smithsonian Institution Bulletin 102, part 7 on "Natural Gas: Its Production, Service and Conservation."

Q Do you know that,that is true and correct?

A I do.

Commissioner Walker. Well, Dr. Wyer, while you are on that point let me inquire of you, does the size of the main that that volume of gas goes through, and the length or the distance of the well from the compressor station, have any bearing on that drop?

[fol 451] A Yes sir, the larger the main, the smaller the friction; but it does have no bearing whatsoever upon the volume. That has been the difficulty with this whole situation; you have confused volume and pressure and have failed to appreciate that volume and pressure are inseparable. You can never have one without having the other, that is, you can't have pressure without having volume.

Commissioner Walker. And the size of the pipe and the distance to the well from a compressor station is involved in a drop in the pressure you have named?

A Any pipe that has the capacity of the compressor engine itself.

Commissioner Walker. Compressor engine itself?

A Yes sir, without any reference at all to length of pipe—behind or in front.

Q In other words you say that if the conditions are such that a compressor at 150 pounds would put through thirty million cubic feet per day——

A (Interrupting.) That refers to the compressing station itself.

Q (Continuing.) —then when it falls to 100 pounds it would be twenty million; in other words, this is relative?

A Correct, correct.

Q Now, when you speak of the reduction of the pressure to the compressor station, you mean the pressure that is made by the gas itself in the well?

A The natural rock pressure in the well itself.

Q And that is what puts the gas to the compressor station to [fol 452] be pumped?

A Correct. I would like to amplify one phase there and that is that gas is never literally pulled out of the well. It always flows out of the gas sand by its own inherent tendency to expand; that is by the inevitable relation of pressure and volume. But the compressor never literally sucks it out. Even if you have got the well below atmospheric pressure, the gas still continue to flow by its inherent tendency to expand and it not, literally, pulled.

Q If a gas company's quantity and volume of gas available to it in extreme cold weather, in periods of peak loads, becomes so reduced that it does not have enough gas to furnish each of its consumers with the amount of gas that each demands, is it possible for the company to furnish what it does furnish to them at a four ounce pressure?

A Physically impossible.

Mr. Richardson. That is all.

Cross-examination.

By Mr. Ratliff:

Q. You do admit, doctor, that the capacity of the pipe line has a great deal to do with the pressure at which gas may be delivered for consumption?

A. Certainly, but the size and length of the lines in no way affects the volume of gas, as you can't make more gas by using a larger line.

Q. The testimony that you have given here with respect to the relationship of the volume and pressure, is taken from the bulletin [fol. 453] referred to by you?

A. Correct.

Q. And was that bulletin used in your testimony before in this case?

A. I can't say from memory.

Q. You did testify in this case a whole day, before, didn't you?

A. I would undoubtedly refer to that bulletin.

Q. And that same testimony, the testimony given here this morning, was covered by your testimony in that former hearing?

A. I can't say whether the phases that were brought out this morning were brought out then.

Mr. Ratliff. That is all.

Mr. Richardson. That is all.

(Witness excused.)

H. D. Hancock, called as a witness in behalf of the appellants herein, having first been duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. What is your name?

A. H. D. Hancock.

Q. Are you the same H. D. Hancock that testified in this case before?

A. I am.

Q. State to the Commission whether or not any relation exists be- [fol. 454] tween volume and pressure in natural gas.

A. There is a relation. You cannot have pressure without volume. There is an inseparable relation between the two, the pressure and volume of gas.

Q. If a gas company has a supply of gas sufficient to enable it to furnish all its consumers with gas at a pressure of four ounces and that supply becomes considerably reduced, is it physically possible for the company thereafter to furnish gas to its consumers at a four ounce pressure?

A. It is not.

Q When a company is furnishing gas at any given pressure, is that indicative of any certain quantity of gas that it has? In other words——

A (Interrupting.) Not necessarily. There may be reserves which are back of it.

Q What I mean, is it indicative that it has at least so much?

A Yes, it is indicative that they have an amount equal to the amount they are furnishing.

Q Now, I want to ask you this, also. If a person is getting gas at a four ounce pressure, is he getting more gas than he would get in the same period of time through the same appliances at a two ounce pressure?

A With no other changes being made at all, he is.

Q Other conditions being the same.

A Other conditions being the same he would get more gas at four ounces than he would get at three ounces or less.

[fol 455] Q In other words more gas would flow through the same meter and same appliances there, other conditions being equal, at a four ounce pressure, than would at a three or a two or a one?

A Correct.

Q Then the pressure at which gas is furnished, other conditions being equal, has more to do with the quantity a person is getting, than anything else, doesn't it?

A Yes, and that quantity is largely in control of the customer.

Q Now, will a compressor, a pump or compressor, pump as much gas and keep up as great a pressure on the consumer's premises if the quantity available to it is small, as it would if it was large?

A It would pump less as the quantity available decreases.

Q Then, in order that a compressor shall pump gas and keep up pressure, there must be gas for it to pump?

A There must be.

Q And not only that, but an adequate quantity?

A An amount equal to the amount which is consumed on the consumption end of the line.

Q If then, a gas company, in periods of extreme cold weather when it is carrying peak loads, has not enough gas to supply its consumers with all of the gas that they want, on demand, is it physically possible for that company to maintain a pressure in its consumers' appliances of four ounces?

A It would be physically impossible because with the given [fol 456] distributing system full of gas at four ounces pressure, should the consumers take out slightly less than one per cent of that gas, out of the mains, the pressure would immediately fall to two ounces, by the taking out of one per cent of the gas; that large decrease in pressure would take place. The reverse is true, that if one per cent would then be put back into the mains, the pressure would again be increased to four ounces.

Q In other words the difference in the volume of gas in a given container at four ounces and two ounces, is just one per cent?

A Practically one per cent.

Q Now, then, I want to ask you this. If you were going, therefore, to furnish consumers with gas when you didn't have enough,

with gas at four ounces, it would be necessary to periodically shut off all their burners while you packed the line, wouldn't it?

A. If gas were going to be used at four ounces that would be the only arrangement under which such gas as was used could be used at four ounces.

Q. Then, as soon as they lit the gas after they had their burners shut off while you packed your lines and filled them, as soon as they lit it again the pressure would go down?

A. In case it was consumed at a greater rate than supplied to the system, yes.

Q. And if they demand four ounces and you can't maintain four ounces, that means they are demanding more gas than you have got?

A. If the pressure falls it is indicative of it being used at a greater [fol. 457] rate than it is being supplied.

Commissioner Walker: While you are on that point, the same condition exists at three or two or one ounce, doesn't it? It would drop? Even one ounce would be the same and it would drop? The same conditions apply?

A. The same conditions apply, yes sir.

Commissioner Walker: Even one ounce would be the same?

A. Yes sir.

Mr. Richardson: That is all.

Mr. Ratliff: Mr. Stockwell wants to ask a few questions.

Cross-examination.

By Mr. Stockwell:

Q. I understood you to say that the consumer using gas at three ounces through a certain appliance, that gas at that pressure, if it was raised to four ounces he would use more gas through the same appliance with no other changes?

A. With no other changes being made except the increase of pressure there would be a greater volume of gas flow through that appliance.

Q. Providing he would get more heat value from that, then, would he not?

A. No, he would use a greater quantity of gas.

Q. He would use a greater quantity of gas and therefore he would burn more gas?

A. And therefore he would burn more gas, yes.

[fol. 458] Q. Due to the fact that the pressure being increased would tend to force more gas through a certain sized orifice?

A. That is correct, that is, assuming that he did not change the adjustment of his burner valve at all.

Mr. Richardson:

Q. That is in the same given time?

A. In the same given time.

Mr. Richardson: Is that all?
Mr. Stockwell: That is all.

Cross-examination (continued).

By Mr. Ratliff:

Q. You testified in this case before, Mr. Hancock, didn't you?
A. Yes sir.
Q. You testified to these same things, didn't you, in that?
A. Yes sir, the same facts.

Mr. Ratliff: That is all.
Mr. Richardson: I don't think he did but that is all right.

A. The same fundamentals.

Mr. Richardson: All right; that is all.

(Witness excused.)

Mr. Richardson: Now, I offer to prove the same facts by Mr. Musson. Is it necessary to put him on the stand to prove that? I will do this, though.

[fol. 459] H. E. Musson, called as a witness in behalf of the appellants herein, having been first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Mr. Musson, you are a natural gas engineer, are you not?
A. Yes sir.
Q. You have heard the testimony of Mr. Wyer and of Mr. Hancock, have you not?
A. Yes sir.
Q. In regard to the relation between pressure and volume?
A. Yes sir.
Q. Is that testimony true and correct?
A. Yes sir.

Mr. Richardson: That is all I will ask of Mr. Musson.

Mr. Ratliff: Did you testify in the other case?
A. No sir.

(Witness excused.)

Mr. Richardson: Now, can we stipulate about the franchise and things?
Mr. Ratliff: I think so. I haven't read the franchise. I glanced over it hurriedly and I think the Judge is right about that.

Commissioner Walker: As I understand it the points that you [fol. 460] are stipulating on is that the franchise does not provide for any certain pressure or any certain quantity or anything.

Mr. Richardson: The franchise makes no reference to the subject in any way, form or fashion.

Mr. Ratliff: Let that stipulation stand pending my scrutinizing the document.

Commissioner Walker: Why don't you introduce the franchise?

Mr. Ratliff: I think we had better stipulate it.

Mr. Richardson: Now, you have got those and you may look them over and Mr. Sharp has copies of their franchise and they both testified that they did not—the franchise——

Mr. Ratliff (interrupting): Let this be the stipulation. Let that stipulation stand but in case I find that there is something in there why we will consider the franchise itself in the record.

Mr. Richardson: All right. Then may I dictate this stipulation? I will dictate it subject to your approval.

Mr. Ratliff: All right.

Mr. Richardson: It is hereby stipulated and agreed by and between the attorney representing the Corporation Commission and the Corporation Commission, on the one hand, and the Oklahoma Gas & Electric Company and the Oklahoma Natural Gas Company, [fol. 461] on the other hand, that neither the franchises of either the Oklahoma Gas & Electric Company or the Oklahoma Natural Gas Company, and neither their articles of incorporation or charter, make any provision with respect to the pressure at which gas shall be furnished or with respect to the quantity that shall be furnished.

That is subject to Mr. Ratliff's approval and will be subject to his examination of the franchises. In the event that it is not correct the franchises will be offered in evidence. Is that correct Mr. Ratliff?

Mr. Ratliff: That is correct.

Mr. Richardson: Now, then, that concludes this with one exception and that is that Mr. Sharp omitted to bring a copy of that contract that existed between the Oklahoma Natural and the Oklahoma Gas & Electric, and I want leave to get that and insert it.

Mr. Ratliff: I have no objection to that.

Commissioner Walker: That is the relation of the division of the proceeds?

Mr. Richardson: Yes, there was a provision in there that in the event—It recited this provision. That the furnishing of natural gas being subject to the supply and the supply being uncertain, that it is hereby contracted and agreed that the company should not be liable for any diminution or failure of the supply. That was the contract that was in there between the Oklahoma Gas & Electric Company [fol. 462] and the Oklahoma Natural Gas Company, isn't that so?

Mr. Owens: Yes sir.

Mr. Richardson: Couldn't we agree on that?

Mr. Ratliff: I will agree you may supply that contract.

Mr. Richardson: All right.

Mr. Ratliff: Is that contract on file with the Commission?

Mr. Richardson: Yes, copies of it are on file with the Commission.

Mr. Ratliff: I will agree, then, that a certified copy of the contract on file with the Corporation Commission be filed in the records of this case as a part of the testimony.

Mr. Richardson: All right. Now I want to ask Mr. Sharp one question.

R. C. SHARP, called as a witness in behalf of the appellants herein, having been first duly sworn, testified as follows:

Direct examination.

By Mr. Richardson:

Q. Mr. Sharp, you are the same R. C. Sharp that testified in this case before?

A. Yes sir.

Q. You were the vice president of the Oklahoma Natural Gas [fol. 463] Company during the winter of 1919-20?

A. Yes sir.

Q. And you were active in the management of its affairs?

A. Yes sir.

Q. You testified before in regard to the supply of gas. I want to ask you this question: Was it possible for the Oklahoma Natural during the period complained about in the winter of 1919-1920 to maintain a pressure of four ounces or three ounces?

Mr. Ratliff: I believe, now, I believe that has been gone over time and time again.

Mr. Richardson: No, we only talked about the supply there. We never said anything about the pressure. We did go into what the relative heat units at various pressures were, but the Supreme Court of the United States seemed to get the idea——

Mr. Ratliff (interrupting): I think that question was testified to by Mr. Sharp and other witnesses before.

Mr. Richardson: No, I am certain it was not. I have gone over it carefully with that in view to ascertain that.

Mr. Ratliff: All right.

Q. Was it physically possible to do so?

A. No sir.

Mr. Richardson: That is all.

[fol. 464] Cross-examination.

By Mr. Ratliff:

Q. What do you mean by "physically impossible," Mr. Sharp?

A. The demand was so much greater, Judge, than the volume of gas that we could deliver—that we had to deliver——

Q. (Interrupting.) Now, isn't the physical possibilities with respect to the deliveries of gas and the pressure of gas a matter of business judgment and ability to drill wells and bringing in producing wells?

A. We purchased at that time all the wells—all the gas that was available to our lines and also drilled a large number of wells—I have forgotten how many, but we drilled——

Mr. Richardson (interrupting): That was all gone over.

Q. I will ask you this question: A man with one gas well who might be supplying a small town and during a cold snap would be unable to supply that town on account of the cold weather on account of the lack of sufficient pressure and gas, couldn't he testify it was physically impossible for him to furnish gas under those conditions, with one well?

A. If he was delivering all the gas that his one well had, and his demand was in excess of what that one well would deliver, that would be true.

Q. Irrespective of whether or not he used good business judgment and used the necessary precautions in securing sficient supplies of gas before the cold weather came on?

[fol. 665] A. We had a sufficient supply of gas before the cold weather came on, but nobody in God's green earth can guarantee, Judge, how long it is going to last, and that got away from us in thirty days.

Q. You mean you had a sufficient supply for the weather that existed at the time you had the sufficient supply?

A. No, we had a sufficient supply that would have taken care of any weather we might have, but it was cut in two in thirty days.

Q. But the fact is, during the previous years, during 1917 and 1918, that you had had an insufficient supply and the case before the Commission involved 1919, didn't it?

A. We had all the gas we could get but the demand came faster than the supply would take care of.

Q. Had you taken any extraordinary steps during the summer of 1919, after the rebate order for the years 1917 and 1918, to secure an adequate and sufficient supply for the winter of 1919?

Mr. Richardson: Now, if you will pardon me, that was all gone into. He testified to all the drilling he did and expenditures and pipe lines and the fact that they were purchasing all the gas they could get.

Mr. Ratliff: That is what I said when he took the stand.

Mr. Richardson: What I am asking is with respect to the pressure. I am asking whether or not it was physically possible for them to have maintained the four ounces pressure because of the diminished supply of gas.

[fol. 666]

Mr. Ratliff: Well, that question would be objectionable because it calls for a conclusion of Mr. Sharp. It is a conclusion, absolutely.

Mr. Richardson: No, I don't think so. All I had in mind was Mr. Ratliff was doing what he didn't want me to do and that was going through and rehashing the old case.

Commissioner Walker: Are you through?
Mr. Ratliff: That is all.
Mr. Richardson: That is all.
Commissioner Walker: Call the next witness.
Mr. Richardson: That is all for us.
Commissioner Walker: Anything further in this case?
Mr. Richardson: No, that is all.
Commissioner Walker: Let the case be closed.
Mr. Ratliff: With this exception: I don't know whether we want to close the case or not. We have no testimony to offer at this time but I don't know whether the case wants to be closed from the standpoint of the Commission for the reason we have no gas engineer here at present who has made a study of the situation and for that reason we could not offer any testimony.
Commissioner Walker: Let it be understood this way. The transcript of the proceedings we had this morning will be prepared and [fols 467 & 468] gotten out at once. Mr. Ratliff, the attorney for the Commission, will go through that transcript and after looking it over if he decides the State should introduce some additional testimony in this case, the case will be held open for him to do that. With that understanding the case will be closed.

BEFORE CORPORATION COMMISSION OF OKLAHOMA

COMMISSIONER'S CERTIFICATE

I, Art L. Walker, a member of the Corporation Commission of Oklahoma, do hereby certify that the above and foregoing is a true, correct and complete transcript of the evidence offered and taken before the Corporation Commission of Oklahoma in the cause above entitled and numbered on October 14, 1922, in pursuance to the order of this Court made in said cause on September 26, 1922.

Art L. Walker, Commissioner

Attest: G. F. Smith, Secretary. (Seal.)

[fol. 469] BEFORE CORPORATION COMMISSION OF OKLAHOMA

EXHIBIT IN EVIDENCE

Ordinance No. 1119

An ordinance granting to the Oklahoma Gas & Electric Co., its successors and assigns, the right to acquire, construct, maintain and operate a system of works in the city of Oklahoma City, State of Oklahoma, for the purpose of distributing and selling natural gas and manufactured gas to said city and the public generally.

Be it ordained by the Mayor and Councilmen of the City of Oklahoma City, State of Oklahoma:

Section 1. The word "City" as hereinafter used shall designate the City of Oklahoma City, Oklahoma County, Oklahoma, and the word "Grantee" as hereinafter used shall designate the Oklahoma Gas & Electric Company, a corporation organized under the laws of Oklahoma, and its successors and assigns.

Section 2. For and during the term of twenty-one (21) years from and after the approval of this franchise by vote of the electors of said City as hereinafter mentioned, the said Grantee is hereby empowered to acquire, construct, maintain and operate a system of works in said City as now existing and as may hereafter be extended for the purpose of distributing and selling to said City and to the public generally artificial and natural gas; and for such purposes said Grantee shall have the right to enter upon and lay its mains and pipes through and in the streets, avenues, alleys and public places of said city, provided, however, that said Grantee shall in all cases save the City harmless by reason thereof and shall restore all said streets, avenues, alleys and public places to their original condition as speedily as possible, at the expense of the Grantee.

[fol. 470] Section 3. During the life of this franchise said Grantee shall have the right to charge said City and the inhabitants thereof not to exceed thirty-five cents per thousand cubic feet for natural gas furnished, provided, however, that said Grantee in every case where the consumer's bill is less than One Dollar per month may charge a minimum rate of One Dollar per month for each service connected.

Section 4. Should the supply of Natural Gas available to the Grantee fail during the life of this franchise, thereafter said Grantee shall have the right to furnish to said City and the inhabitants thereof, artificial gas, and shall have the right to charge therefor not to exceed $1.00 per thousand cubic feet.

Section 5. All bills shall be due and payable ten (10) days from the date of the rendering thereof, and upon failure of any consumer to pay any bill within fifteen (15) days from such date, the Grantee may discontinue the service of such consumer and said Grantee shall not be required to furnish service to any such consumer until he has first paid all indebtedness, and in addition thereto a sum not exceeding One Dollar ($1.00) as a charge for reconnecting said consumer.

Section 6. No deposit for meter or meters shall be required or exacted, but for the protection of Grantee from financial loss, and as security for the payment of bills for service rendered, Grantee may require and the consumer shall, if Grantee demands, deposit with it, for which it shall issue a receipt, a sum or amount of money equal to the estimated service for one and one-half months, upon which [fol. 471] Grantee shall pay to such consumer annually interest at 5 per cent per annum. And at the time service is discontinued the deposit less any moneys the consumer may owe to the Grantee at that time shall be immediately returned to the consumer.

Section 7. The Grantee shall have the right to assign to any other person, firm or corporation, the rights and obligations of this fran-

chise, and any assignee thereof, by accepting said assignment, shall become bound thereby, but in the event of any assignment said assignment shall be in writing and a duly authenticated copy thereof shall be filed with the City Clerk of said City.

Section 8. The franchise hereby granted shall not be operative unless and until the same shall be approved by vote of a majority of the qualified electors residing within said City who shall vote thereon at the special election called under and pursuant to the provisions hereof, and if the franchise hereby granted shall fail to be so approved at said election, no rights shall accrue hereunder.

Section 9. A special election is hereby called for the purpose of submitting to the qualified electors residing within said City the question of the approval or disapproval of the franchise hereby granted, which election shall be held on the 29 day of October 1909, between the hours of — A M and — P M. The Mayor of said city is hereby authorized and directed to issue a call for and a notice of such special election to be held on such date for such purpose, and the proper officers of said City are hereby directed to give due and lawful notice of said election and to take all steps that may be necessary for the holding of said election and for the submission of said question at [fol. 472] said election to the electors of the City.

Section 10. In case the franchise hereby granted shall be approved at said election, the said Grantee shall file with the Clerk of said City, within fifteen (15) days after the date of such approval, a written acceptance of this ordinance, and upon failure of the Grantee to file such acceptance, then no rights whatever shall accrue to the Grantee hereunder.

Section 11. It is hereby further agreed by and between said City of Oklahoma City and said Grantee that at the expiration of said term of twenty-one (21) years the said City shall have the right to purchase all of the property, rights, franchises and contracts of whatsoever kind or nature then owned by the said Grantee under the provisions of this ordinance; provided, however, in the event such parties are unable to agree upon a purchase price of said property, each party shall select as appraiser one gas engineer, of well known experience and ability, who shall neither be a resident of said City, nor a tax payer therein, nor in any wise interested in said purchase, and if such two appraisers are unable to agree upon price they shall select a third, possessing the same qualifications and the three shall proceed to fix a purchase price and the price so fixed shall be binding upon said City and Grantee. And provided further, that in the event said City desires to make the purchase herein provided for, it shall give said Grantee sixty days' notice in writing prior to the expiration of said term of twenty-one (21) years.

Section 12. The Mayor and Council and their successors shall at all times have power to impose all needful and reasonable regula- [fol. 473] tions for the protection of the interest of the inhabitants of said City, and among other things shall have the power, after full

hearing, to require extensions of service where it can be done without financial loss to the Grantee. The Grantee may, if it desires, extend its distributing system into any communities or territory outside the limits of said City, and may supply the inhabitants of such communities or territory with gas from said system, maintained and operated hereunder.

Section 13. If at the end of said term of twenty-one (21) years said City shall not have exercised its right of purchase under Section 11 of this ordinance, all rights hereinabove conferred upon the Grantee for the term of twenty-one (21) years shall continue in said Grantee for the additional term of four (4) years from and after the expiration of said term of twenty-one (21) years, subject, however, to the right of purchase by said City at the end of each of said additional four (4) years upon like notice and like terms and conditions as are provided in Section 11 for the purchase by said City at the end of said term of twenty-one (21) years.

Section 14. Immediate extensions of said Grantee's existing system, whereby gas may be provided for heating purposes and the lighting of buildings, streets and public places that are now unlighted, are in the judgment of the Mayor and Councilmen necessary for the immediate preservation of the peace, health and safety of the inhabitants of said City, and therefore an emergency is hereby declared to exist and this ordinance shall take effect and be in force upon its passage and approval by the Mayor and publication as required by law.

[fol. 474] Section 15. If the franchise hereby granted shall be approved at said election and the Grantee shall, within fifteen (15) days after the date of such approval, file with the clerk of said City its written acceptance of this ordinance as hereinabove provided, then upon such acceptance all rights, privileges, and obligations of the Grantee conferred or imposed upon it by any and all former ordinances of said City under which the Grantee's existing system of gas works was constructed or has been heretofore operated and maintained, shall be annulled, abrogated and stand repealed and after such acceptance said existing system shall be operated, maintained and extended solely under the provisions of this ordinance.

Passed and approved this 24th day of September 1969.
Published this 25th day of September 1969.

(Signed) Henry M. Scales, Mayor.

(Signed) Bob Parman, City Clerk. (Seal.)

I, Bob Parman, City Clerk of the City of Oklahoma City, Oklahoma, hereby certify that the above and foregoing is a true and correct copy of Ordinance No. 4119, as appears on record in my office.

Bob Parman, City Clerk. (Seal.)

(Endorsements: Gas Franchise, Oklahoma City. Ordinance #4119. Granted Oct. 29, 1969. Expires Oct. 29, 1930. File F No. 37.)

[fol. 475] BEFORE CORPORATION COMMISSION OF OKLAHOMA

EXHIBIT IN EVIDENCE

Contract Between Oklahoma Natural Gas Company and Eugene Mackey

[fol. 476] Articles of agreement made and entered into this twenty-second day of May, in the year of our Lord one thousand nine hundred and seven, by and between the Oklahoma Natural Gas Company, a corporation duly created, organized and existing under and by virtue of the laws of the Territory of Oklahoma, hereinafter denominated the "Gas Company," party of the first part, and Eugene Mackey, of Pittsburgh, Pennsylvania, party of the second part.

Whereas, the Gas Company controls an acreage of gas lands and leaseholds, with a number of gas wells thereon, situate in the gas belt of Oklahoma and Indian Territories, and also owns certain contracts for the purchase of natural gas produced from certain other lands and leaseholds in the said Territories, and desires to market the gas produced from the said lands and leaseholds and purchased under the said contracts; and

Whereas, the second party desires to be appointed the agent of the Gas Company within the City of Oklahoma, Oklahoma, and within a radius of five miles from the limits of said city to market its natural gas to the inhabitants thereof, and of the said five mile radius.

Now, therefore, in consideration of the premises and the mutuality hereof, as well as of one dollar lawful money of the United States of America unto each of the parties hereto by the other paid, the receipt whereof is hereby acknowledged, as well also as of the mutual [fol. 477] covenants, promises and agreements from each of the said parties to the other given, entered into or undertaken, as hereinafter recited, these articles witnesseth:

First. The Gas Company agrees to lay and construct, or cause to be laid and constructed on or before December 23, 1907, unavoidable delays excepted, a pipe line for conveying natural gas from the said gas lands and leaseholds to a point at the corporate limits of the said city of Oklahoma to be located by mutual agreement, on the side thereof at which the said pipe line of the Gas Company approaches the city, and set, install and maintain at such point a reducing and regulating station through which to deliver natural gas into the mains and pipes of the distributing system of the second party.

Second. The Gas Company agrees that it will, for the period commencing with the completion of its said pipe line and ending October 15, 1927, or at a later period as hereinafter provided, supply and deliver through its said pipe line and through its said reducing and regulating station, natural gas in a volume sufficient to maintain

a pressure not to exceed four to eight ounces to the square inch on the lines of the said distributing system, and at all times fully meet the demand for all purposes of domestic consumption as provided for in this contract. However, as the production of natural gas from wells and the conveying of it over long distances is subject to accidents, interruptions and failures, the Gas Company does not by this contract undertake to furnish an uninterrupted supply of gas [fol 478] at the pressure named, for the period named herein, but only to furnish such a supply of gas at such pressure and for such a period of time as its wells and contracts and pipe line are capable of furnishing.

Third. It is expressly understood and agreed, however, that the Gas Company shall not be liable for any loss, damage or injury sustained by the second party and resulting directly or indirectly from any shortage or interruption in the supply of gas, or in the diminution of the pressure thereof, arising from any cause whatsoever, but the Gas Company agrees to use due diligence in furnishing an adequate supply of merchantable gas for all the domestic contracts the second party may secure within the corporate limits of the city of Oklahoma as the said limits now exist or may hereafter be established by law, as well as within a radius of five miles from the present or future limits of said city.

Fourth. The Gas Company hereby gives and grants unto the second party the sole and exclusive agency to distribute, market and sell its natural gas for domestic and manufacturing consumption within and to the said city of Oklahoma and to the inhabitants thereof, and within a radius of five miles from the limits thereof, such agency to run and continue until October — 1927, or longer as hereinafter provided for, unless sooner determined by the mutual consent of the parties hereto or by breach of some of the promises, covenants and agreements of either party herein set forth and noted, and continue for thirty days after notice thereof to the defaulting party by the other party hereto given, the full and faithful performance of which promises covenants and agreements is the [fol 479] condition upon which this exclusive agency is granted and is to be exercised, unavoidable casualties excepted, but so long as the second party fully and faithfully keeps and performs its promises, covenants and agreements herein contained, the Gas Company agrees that this agency to the second party shall be an exclusive one, and the Gas Company agrees that it will not itself distribute, market or sell natural gas in the said city or within a radius of five miles from the limits thereof, for domestic or manufacturing purposes or for any purposes whatsoever, or do so by or through others. The exclusive agency granted to the party of the second part may be transferred to the Oklahoma Gas and Electric Company or to some corporation that may be organized, and upon such transfer the party of the second part shall be released from all liability hereunder, and thereafter the agency hereunder shall not be again transferable, either by voluntary act or by operation of law without the consent of the Gas Company to such transfer first had and

obtained in writing and endorsed hereon, except, however, that if the agent hereunder or his transferee mortgages its distributing system for securing the bonds, it may include in such mortgage this contract and all its rights hereunder, and any purchaser upon a foreclosure or sale under the said mortgage shall take and hold this contract and all rights hereunder as fully and completely as the party of the second part could or does hold the same, but thereafter the purchaser shall not transfer this agency either by voluntary act or by operation of law without the consent of the Gas Company to such transfer first had and obtained in writing and endorsed hereon.

[fol. 480] Fifth. The second party agrees to lay, build and construct, at its own cost and expense, in the said city of Oklahoma, and have fully completed and ready for the distribution of gas on or before December 23, 1907, a complete distributing system of pipe lines or mains, including all necessary attachments, connections, service pipes and appliances, in, through and along the streets, avenues, alleys, public grounds and places in the said city, and within a radius of five miles from the limits thereof, sufficient in size, length and capacity to fully supply natural gas for domestic consumption to the said city, and within a radius of five miles from the limits thereof, and all the inhabitants thereof who may desire to purchase the same for domestic consumption, and will, unless prevented by the default of the Gas Company, actually begin to receive the said gas from the said Gas Company, and distribute and sell the same through its said distributing system to domestic consumers thereof within the said city, and within a radius of five miles from the limits thereof, on or before January 1, 1909, and will continue so to do, under and according to the terms hereof, until October 15, 1927, or longer as hereinafter provided; but it is expressly understood and agreed that the second party in the construction of the said natural gas system, may adopt and use all or any part of any present manufactured gas distributing system in the city of Oklahoma. It is further understood that the second party shall not be compelled to lay, build and construct its said system in the said city or within the territory endorsed within a radius of five miles from the said limits of the said city faster than the number of consumers within such city and territory will warrant.

[fol. 481] Sixth. The second party further agrees to build, construct and maintain the mains or lines of his said distributing system of a size at all times to deliver an ample supply of the said gas for domestic consumption to the said city and to all the inhabitants thereof at a pressure not to exceed four to eight ounces per square inch on the principle main lines of said distributing system; to exercise and use at all times hereafter the highest degree of care in keeping and maintaining the appliances, pipes, mains, lines and connections of the said distributing system so that the same shall at all times hereafter be and remain in the highest and best order, repair and condition; to immediately repair all leaks, waste or escape of gas from any part or parts of the said distributing system wherever the same

are called to his attention by the Gas Company; to extend mains for new customers whenever and wherever he may secure and furnish a responsible customer for each hundred feet of such extension, the second party having the right to make a reasonable charge to the consumer for pipe and appliances from the curb to the point of consumption; to make proper connections with and attachments to the pipe line of the Gas Company at the said reducing and regulating station; to locate and furnish an office at some convenient point in the said city; to employ in the said office and in the said city all the clerks and employees necessary to carry on the business of supplying natural gas therein, and to pay the wages of such clerks and em- [fol. 482] ployees; to make all contracts for supplying natural gas to domestic and manufacturing consumers, and at all times during the continuance of this contract, by advertisement, solicitation and all other means, to do all things necessary to build up, extend, improve, manage, enlarge and conduct the said business of furnishing natural gas within the said city. It is, however, expressly understood that the Gas Company shall not be forced by any provision hereof to supply only the second party with natural gas from its said wells, contracts and line, but may supply companies and consumers in other cities and localities; but if the gas from its wells and contracts should ever become insufficient to supply all the companies and cities and consumers with which it has contracts, the Gas Company shall distribute its gas pro rata among the several cities, companies and consumers supplied by it in proportion to the amount of consumption in or by the said cities, companies and consumers.

Seventh. The second party further agrees to use only first class material in the construction of his said distributing system and the alterations, repairs and extensions thereto; to construct, alter, repair and maintain the same in a good and workmanlike manner; to assume and discharge all expense, cost, labor and risk incurred in the construction, repair, operation and management of the said distributing system, and the distribution and sale of natural gas within the corporate limits of the said city and within a radius of five miles from the limits thereof, from the point where connections are made with the said reducing and regulating station of the Gas Company; to pay and discharge all taxes and assessments levied at any time whatsoever on any property of the second party within and without [fol. 483] the said city, it being the intent and purpose of this contract that all and every cost and expense of whatsoever nature and kind incurred in the building, extension and repair of the said distributing system, and in the transportation, marketing and sale of the said gas after it leaves the said reducing and regulating station of the Gas Company shall be borne and paid for exclusively by the second party, and that all mains and pipes used in the transportation and marketing of the said gas after it leaves the said reducing and regulating station shall be furnished, maintained, used and owned exclusively by the second party, and he and he alone, and not the Gas Company, shall be liable for any expense or damage arising from the negligent or careless construction, repair or maintenance of such mains and pipes between the said reducing station and the consumer.

Eighth. The second party agrees with the Gas Company that the price charged and collected by the second party for the natural gas of the Gas Company distributed and sold to the domestic consumers within and without the said city during the continuance of this contract, shall be thirty-five cents per thousand cubic feet, and he shall allow a discount of not more than ten per cent on all bills paid on or before the tenth day of the month following that in which the gas was consumed, and shall also charge a minimum rate of not less than one dollar per month for service to each consumer, but such minimum rate shall not be charged when the monthly gas bills are in excess of one dollar, and shall only charge when they are less than one dollar. The second party expressly agrees that he will not sell [fol. 484] any of the gas of the Gas Company except for domestic consumption in the said city unless with the written consent of the Gas Company, but provided, however, that with the written consent of the Gas Company, but not otherwise, the second party may sell gas for manufacturing purposes within the said city and within a radius of five miles from the limits thereof, but only upon such price and terms as the Gas Company may in writing consent to; and if the second party sells gas for manufacturing purposes without such written consent of the Gas Company, such sales shall be treated as domestic sales and settlement therefor made with the Gas Company upon the price of domestic consumption.

Ninth. The second party further agrees to pay to the Gas Company at its general office, wherever the same may be located, on or before the twentieth day of each and every month during the continuance of this contract, sixty-six and two-thirds per cent of the gross collections from the sales of natural gas during the preceding month for domestic consumption, including the minimum charges above provided for, and seventy-five per cent of the gross collections of gas sold for manufacturing purposes upon the written consent of the Gas Company as above provided for. The second party agrees to cut off all parties who are delinquent on the fifteenth day of the month for gas sold and delivered during the preceding month, and to use all reasonable efforts to collect such delinquent bill or bills, and if at any subsequent time or times any delinquent bill or bills shall be paid in whole or in part, the second party shall pay to the Gas Company its proper percentage thereof, to wit, sixty-six and two-thirds per cent of delinquent domestics, and seventy-five per cent of [fol. 485] delinquent manufacturers. All receipts by the second party from the sale of natural gas within or without the said city over and above the percentage thereof provided for or agreed upon to be paid to the Gas Company, shall be kept and retained by the second party as full payment for his services and expenditures in distributing, marketing and selling the said natural gas within the said city or within a radius of five miles from the limits thereof.

Tenth. The second party further agrees to do or procure to be done all plumbing necessary to make service connections between the mains and curb for customers free of cost to consumers, to furnish all meters used by consumers, to require each consumer

to sign a contract for gas before connections are made with the second party's pipes or mains or gas is turned into the house or service pipes of such consumer, which contract shall be of a form furnished by the Gas Company or first submitted to or approved by it; to supply all gas sold by him only through meters of a standard make and style satisfactory to and approved by the Gas Company. The meters now in use in the city of Oklahoma for the measurement of manufactured gas are hereby permitted to be used by the second party for the measurement of natural gas. The second party agrees to correctly read and inspect all such meters once each month and to keep the same in good working order and efficiency so that each meter shall register within two per cent of the actual amount of gas passed through it when tested at a pressure of three inches of water and sixty degrees Fahrenheit; to permit the officers or [fol. 486] authorized agents of the Gas Company at all times to inspect its mains, pipes, regulators, meters and appliances for the purpose of verifying its monthly statements as herein provided for, and for the purpose of determining the condition of the said mains, pipes, regulators, meters and other appliances, and to forward to the Gas Company a weekly record of the number of meters set, connected and disconnected, together with the total number of consumers at the end of each month; and make and keep at his office a copy of all contracts with consumers, together with a full and complete record of the same, and of all meters used, and also all such books of account as will clearly and fully show all accounts and contracts with consumers as well as all other transactions and matters relating to his said business; to keep all of its said books of account and its records relating to the sale of gas within and without the said city in a form and manner satisfactory to both parties; to make all statements required hereunder upon a form mutually approved; which books of account, contracts and records, together with any and all papers relating to or connected with his said business matters under this agreement and contract, shall be at all reasonable times open to the examination and inspection by the officers, agents, attorneys and employees of the Gas Company, and whenever requested to aid and assist by its officers, agents and employees, the officers, agents, attorneys and employees of the Gas Company in making such examination and inspection; to make and deliver to the Gas Company at its general office, wherever the same may be located, on or before the fifteenth day of each and every calendar month during the con- [fol. 487] tinuance of this contract, a full and true statement showing in detail the amount of gas sold and delivered to consumers during the preceding month and the amount collected therefrom, and also the amount of bills for gas sold and delivered to consumers during the preceding month which have not been paid.

Eleventh. In consideration of the exclusive agency for the sale of its gas within the said city granted by the Gas Company to the second party, the second party covenants and agrees to and with the Gas Company that he will not during the term of this agency, or any extension thereto, handle, distribute, market or sell within the

said city the natural gas of persons, partnerships, or corporations other than that of the Gas Company. It is expressly understood and agreed, however, by both of the parties hereto, that in the event that the natural gas of other persons, firms or corporations should be hereafter sold in the said city of Oklahoma in competition with the second party, and the Gas Company refuses to agree to a sale of its gas at prices, charges and rates to the consumer which will enable the second party to successfully compete with the gas of such other persons, firms or corporations, then this contract shall be at an end and the second party shall have the right to secure gas for distribution and sale within said city from other sources than the lines and wells and contracts of the Gas Company.

Twelfth. It is expressly understood and agreed that the title to the said gas shall be and remain in the Gas Company until sold and [fol. 188] delivered to the consumer, but as between the parties hereto the point of delivery by the Gas Company to the second party shall be the said reducing and regulating station at the limits of the said city, at which point of delivery the second party accepts the same and agrees to transport, distribute and sell the same to the consumer, and all expense, risk and danger from said transportation and distribution after the gas leaves the said reducing and regulating station shall be assumed and borne exclusively and wholly by the second party, who also agrees to save, indemnify and keep harmless the Gas Company from all claims, demands, charges, costs or damages incurred or claimed by third parties from explosions, accidents or casualties of any and every kind and nature occurring or arising from the said gas while in transit from the said reducing and regulating station to the consumer.

Thirteenth. It is further expressly understood and agreed that the second party shall not be required to account for the gas furnished free to the city of Oklahoma for lighting the city buildings under the terms of a franchise about to be secured.

Fourteenth. It is mutually understood and agreed that if the second party or his assigns of this contract secures an extension of the said franchise or a new one in continuance thereof, then the exclusive agency to the second party to distribute, market and sell the natural gas of the Gas Company in the said city and within a radius of five miles from the limits thereof, shall at the option of [fol. 189] the second party continue through the life of such extension or new franchise, but only upon and subject to the terms and conditions hereof, excepting, however, that the price at which natural gas of the Gas Company shall be sold in the said city during such extension or new franchise is less than that at which the Gas Company is willing to sell its gas, then this contract shall terminate, it being the intent and purport of this contract that the Gas Company shall wholly control the price at which its gas shall be sold within the said city without interference or regulation by the said city. And if the city at any time hereafter attempts to regulate or fix the price at which natural gas shall be sold within the said city and the Gas

Company is not satisfied with such price it may discontinue the delivery of gas hereunder.

Fifteenth. It is expressly covenanted and agreed by and between the parties hereto that if either party for a period of thirty days after written notice so to do, fails or neglects to keep and perform faithfully, fully and well each and every covenant and agreement herein stipulated to be kept and performed by it, unavoidable casualties excepted, then this contract shall, at the option of the party not in default, be cancelled and annulled and all rights of the defaulting party forfeited, and the injured party shall in such case have the right to enforce by action or actions at law, or in equity, all claim or claims for damages or any other claims which it may have against the other party by reason of this contract.

[fol 490] Sixteenth. Time to be of the essence of this contract.

Seventeenth. This contract executed in duplicate.

In witness whereof the first party hereto has caused its corporate name to be hereunto subscribed by its Vice President and its common and corporate seal to be hereunto affixed and the same attested by its Secretary, as also the party of the second part has hereunto set his hand and affixed his seal the day and year first above written.

Oklahoma Natural Gas Company, by (Sgd) C. T. Braden, Its Vice-President. Attest (Sgd) E. H. Bartlett, Its Secretary (Seal) Eugene Mackey (Seal)

I certify the above and foregoing to be a true and correct copy. C. A. O'Donovan, Ass't. Sec'y Oklahoma Natural Gas Co.

Subscribed and sworn to before me this 16th day of October, 1922. W. I. Bowman, Notary Public. My commission expires March 11, 1926. (Seal)

[fol 491] Before Corporation Commission of Oklahoma

Commissioner's Certificate

I, Art I. Walker, a member of the Corporation Commission of Oklahoma, do hereby certify that the above and foregoing is a true, correct and complete transcript of the evidence offered and taken before the Corporation Commission of Oklahoma in the cause above entitled and numbered on October 14, 1922, in pursuance to the order of this Court made in said cause on September 26, 1922.

Art I. Walker, Commissioner.

Attest: G. F. Smith, Secretary. (Seal)

[fol. 492] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ORDER STRIKING CAUSE FROM ASSIGNMENT—Sept. 14, 1920

And now on this day it is ordered by the court that the above cause be stricken from the October, 1920, assignment.

[fol. 493] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ORDER STRIKING CAUSE FROM ASSIGNMENT—Nov. 30, 1920

And now on this day it is ordered by the court that the above cause be stricken from the assignment pending decision of case in Supreme Court of the United States involving the same question.

[fol. 494] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ORDER SETTING CAUSE—Sept. 26, 1922

And now on this day it is ordered by the court that the motion of Oklahoma Natural Gas Co. to take additional testimony in the above cause, be, and the same is hereby sustained, and the cause is set for submission and oral argument on Oct. 23, 1922.

[fol. 495] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

SUBMISSION OF CAUSE—Oct. 24, 1922

And now on this day the above cause is submitted on the record and briefs filed therein.

[fol. 496] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

ORDER ENLARGING TIME—May 15, 1923

And now on this day it is ordered by the court that plaintiff in error be granted 30 days in which to file reply brief in the above cause.

[fol. 497] IN SUPREME COURT OF OKLAHOMA

[Title omitted]

JUDGMENT—June 2, 1925

And now this cause comes on for final decision and determination by the court upon the record and briefs filed therein.

And the court having considered the same finds that the judgment of the trial court in the above cause should be affirmed.

It is therefore ordered and adjudged by the court that the judgment of the trial court in the above cause be, and the same is hereby affirmed.

Opinion by Maxey, Com'r.

[fol. 498] [File endorsement omitted]

IN SUPREME COURT OF OKLAHOMA, DIVISION NO. 1

[Title omitted]

OPINION—Filed June 2, 1925

Syllabus

The syllabus in Oklahoma Natural Gas Company v. State et al., 78 Okla., 5, is hereby adopted as the syllabus in this case.

Appeal from Order of Corporation Commission

From an order of the Corporation Commission prescribing refund for natural gas service furnished by the Oklahoma Natural Gas Company and the Oklahoma Gas & Electric Company to domestic consumers in Oklahoma City, the Oklahoma Natural Gas Company appeals. Affirmed.

Ames, Chambers, Lowe & Richardson, attorneys for appellant.
E. S. Ratliff, attorney for appellee.

[fol. 499] Opinion by Maxey, C.

This is an appeal from an order of the Corporation Commission made on the 7th day of June, 1920 over ruling the protest of the appellant to certain orders theretofore entered by the Corporation Commission.

The issues arise from certain orders of the Corporation Commission directing the refund to domestic consumers, in certain districts in Oklahoma City where, by said orders, the Corporation Commission fixes a schedule defining what is adequate service in supplying gas

and what is inadequate service and directing the appellant to conform to that schedule. The schedule is as follows:

That 4 ounce pressure or better shall be considered the minimum adequate pressure, and that all gas distributors shall make proper reduction for insufficient service as follows:

1. That during the time when pressure is below 4 ounces and not below 3 ounces to be considered 75 per cent service.

2. During the time when pressure is below 3 ounces and not below 2 ounces to be considered as 50 per cent service.

3. During the time when pressure is below 2 ounces and not below 1 ounce to be considered as 25 per cent service.

4. During the time when pressure is below 1 ounce to be considered of no service.

In this particular order appealed from, the Commission has followed the division of the city in districts in accordance with those designated by the gas companies, and from the testimony figured out what per cent the consumers in each particular district shall be entitled to as a rebate for gas furnished during low pressure.

This trouble over low pressure gas started back some years ago, and the Commission began to work out an adjustment until it [fol. 500] finally adopted the plan above set out. Since the adoption of that plan several cases have reached this court. The first was the case of Nowata County Gas Company v. The State, et al., 72 Okla. 177, and the next one was the case of Oklahoma Natural Gas Company against the State 78 Okla. 5. The facts in the Nowata case, supra, is somewhat similar to the facts in the instant case. In the case last cited the facts are practically identical with the case under consideration. After the case of Oklahoma Natural Gas Company was decided by this court, wherein it affirmed the order of the Corporation Commission, the parties to that case and the parties to this case agreed that the case now under consideration should remain in abeyance on the docket of this court until that case was decided by the Supreme Court of the United States to which it had been appealed. That case was affirmed by the Supreme Court of the United States and is reported in 278 U. S. 234.

After that case was affirmed by the Supreme Court of the United States, the attorneys for appellant in this case applied to this court where this case was then pending, for an order requiring the Corporation Commission to re-open the hearing in this case and permit them to introduce further testimony. That order was made and the Corporation Commission in obedience thereto re-opened the case and permitted the appellant to introduce a large number of witnesses who were principally expert witnesses on natural gas and most of them testified at great length on natural gas and the conservation of natural gas. They define natural gas in volume, atmospheric pressure and gage pressure. These expert witnesses were evidently well informed as to natural gas and some of them, in fact most of them, had been in the employ of different gas companies and mining companies for several years and were able to testify as to the different methods of

[fol. 501] handling gas, and their testimony was duly considered by the Corporation Commission before the entering of the order appealed from. While the testimony of these witnesses is interesting from a scientific standpoint, we do not consider it of very much value in determining the case before us. The testimony, like most expert testimony, is highly technical and based largely on experiments and conjecture, and is such that the average consumer of gas could not understand it, nor apply the methods suggested. One witness testified to over-hauling his cook range so as to make it conform to the plans suggested by these experts and it cost him over $100.00 to adjust his range so as to conform to the methods of handling gas given by these experts. So it will be seen that while the testimony is very scientific it is absolutely impractical to apply it to the ordinary gas consumer. This was undoubtedly the view the Corporation Commission took of this testimony.

Counsel for appellant have assigned 7 errors but argue them under two main heads:

First. The facts and circumstances shows the order is unjust and unreasonable.

Second. The Commission's order is violative of the Fourteenth Amendment to the Constitution of the United States, in that it deprives the companies of their property without due process of law, and denies them the equal protection of the law.

Counsel for appellant have filed elaborate briefs, from their standpoint, and counsel for appellee has also ably briefed the case. But a careful examination of the case of Oklahoma Natural Gas Company v. State, supra, and the case on appeal to the Supreme Court of the United States, supra, shows that both this court and the Supreme Court of the United States passed on both of these questions and un-[fol. 502] less the expert testimony introduced in this case differentiates it from the former case, the decision of this court and the Supreme Court of the United States are binding and controlling. This court in Oklahoma Natural Gas Company v. State, supra, uses the following language in the body of the opinion:

"The question is whether there is evidence in the record to support the Corporation Commission's order. Findings of fact made by the Commission are by Section 22, Art. 9, of the Constitution, prima facie, just, reasonable, and correct. Atchison, T. & S. F. R. Co. v. State, 23 Okla. 510, 101 Pac. 262; Atchison T. & S. F. R. Co. v. State, 23 Okla. 210, 100 Pac. 11, 21 L. R. A. (N. S.) 908; St. Louis & S. F. R. Co. v. Travelers' Corp. of Okla., 47 Okla. 574, 148 Pac. 166; Guthrie Gas, Light, Fuel & Imp. Co. v. Board of Ed., 64 Oklahoma, 166 Pac. 128; City of Pawhuska v. Pawhuska O. & G. Co., 64 Oklahoma, 166 Pac. 1058; Muskogee Gas & Elec. Co. v. State, No. 10635 (not yet officially reported)."

It will be observed that the Constitution of Oklahoma makes the findings of fact by the Commission prima facie just, reasonable and correct. The Commission found that equitable distribution of loss arising from poor and inadequate service, as between the gas com-

panies and the consumers, could be arrived at by discounting the bills for service rendered each month on the basis outlined in said order, and after *quiet* an extensive computation based upon the evidence, the Commission arrived at the conclusion stated in the order hereinbefore set out.

[fol. 503] The record in this case shows that a great deal of testimony was taken by both parties to the suit. In fact, there is very little controversy, as to the facts in the case, and we think the conclusion reached by the Corporation Commission are prima facie just, reasonable and correct. On the second proposition wherein appellants complain that the findings of the Commission are violative of the Fourteenth Amendment of the Constitution of the United States, this question was passed on adversely to the contention of appellant in the Oklahoma Natural Gas Company v. State, supra, and also by the Supreme Court of the United States. So that question is settled. These cases are binding on this court on that question. The record in the case is voluminous and the parties have filed voluminous briefs and we have carefully examined the record and briefs and have carefully read and considered the case of Oklahoma Natural Gas Company v. State, 78 Okla. 5, and the opinion of the Supreme Court of the United States in the same case, 278 U. S. 234 and have reached the conclusion that the additional facts in this case are not sufficient to overturn the findings of the Commission on these facts. We are, therefore, of the opinion that the order of the Corporation Commission appealed from should, in all things, be confirmed, and so recommend.

[fol. 504] IN SUPREME COURT OF OKLAHOMA

CLERK'S CERTIFICATE

I, Wm. M. Franklin, Clerk of the Supreme Court of the State of Oklahoma, do hereby certify that the foregoing 503 pages, numbered from 1 to 503 inclusive, are a full, true and complete transcript of the record and all proceedings in this court, in cause numbered 11,511, Oklahoma Natural Gas Company, a corporation, et al., Plaintiffs in error, versus State of Oklahoma et al., Defendants in error, as the same remain of record and on file in my office.

In witness whereof, I hereto set my hand and affix the seal of said Supreme Court at Oklahoma City, Oklahoma, this 13th day of June, 1927.

Wm. M. Franklin, Clerk Supreme Court Oklahoma. By Jessie Parlee, Deputy. (Seal of Supreme Court, State of Oklahoma.)

The above error in typing transcript was corrected by me.
Jessie Parlee, Deputy Clerk Supreme Court. (Seal of Supreme Court, State of Oklahoma.)

[fol. 505] IN SUPREME COURT OF THE UNITED STATES

STATEMENT OF POINTS TO BE RELIED UPON AND DESIGNATION BY APPELLANT OF PARTS OF RECORD TO BE PRINTED, WITH PROOF OF SERVICE—Filed July 11, 1925

The appellant intends to rely in the above cause upon the following points, to-wit:

I

The Supreme Court of the State of Oklahoma erred in deciding, holding, and adjudging that the order of the Corporation Commission of the State of Oklahoma appealed from does not deprive appellant of its property without due process of law, and does not deny it the equal protection of the law, in violation of the 14th Amendment to the Constitution of the United States, for the following reasons:

[fol. 506] A. It was proved, not controverted, but specifically admitted, that neither the charter, the franchise, nor any contract of appellant or the Oklahoma Gas & Electric Company contained any provision respecting the pressure at which gas should be furnished or the quantity which should be furnished, thus distinguishing this case from the case of Oklahoma Natural Gas Company vs. State of Oklahoma, 278 U. S. 234.

B. The evidence showed, and it was not disputed, that the pressure at which gas can be furnished is wholly dependent upon the volume of gas available, thus further distinguishing this case from the case of Oklahoma Natural Gas Company vs. State of Oklahoma, 278 U. S. 234.

C. Appellant furnished every foot of gas available or which could be made available to it, and had exercised the highest degree of care to procure and furnish an adequate supply, and it was not negligent in the slightest particular.

D. The rate which appellant charged for its gas, fixed and established by the Corporation Commission of Oklahoma, even without the granting of the rebates or discounts ordered, were uncommercial and confiscatory.

E. Appellant not having assumed, either by charter, franchise or contract, to furnish any more gas that it was possible for it to furnish, and having exercised the highest degree of care to furnish an adequate quantity at a sufficient pressure, and it being unable to do so merely because the necessary quantity or volume of gas with which to do so could not be obtained, and the established and existing rates themselves being uncommercial and confiscatory even [fol. 507] without discounts or rebates therefrom, the order forbidding appellant to collect from its patrons the legally established rates for the gas actually furnished and used operates to deprive appellant of its property without due process of law, and to deny it the equal protection of the law in violation of the 14th Amendment to the Constitution of the United States.

F. The order complained of is not supported by a scintilla of evidence, it is arbitrary and capricious and nothing but an administrative fiat.

G. The Corporation Commission's adoption of four ounces as the standard of pressure was done without evidence supporting it, and in the face of overwhelming and undisputed evidence that better service could be given with a pressure of two ounces than with a pressure of four, and the adoption of the four ounces pressure was arbitrary and capricious.

H. The order was arbitrary and capricious in that it was not based upon the relative quantity of gas which a consumer might get at the various pressures, or upon the relative heating value of the gas furnished at the various pressures, or upon both combined.

I. The order granted relates to hundreds of consumers whose regular bills were incurred when gas was at the prescribed pressure, and to give such consumers discounts or rebates upon gas furnished at the prescribed pressure is to take appellant's property without due process of law.

(fol. 508) J. The order permits consumers to burn appellant's gas twenty-four hours in the day when the pressure is less than one ounce, which is a usable pressure, and yet denies appellant any compensation whatsoever for the gas so used and burned.

K. The order undertakes to impose upon appellant, the basis of whose service is an exhaustible commodity which man cannot make, an absolute obligation to furnish an adequate quantity at all times under all circumstances, and in all events, and that, notwithstanding it was humanly impossible to do so, and notwithstanding the fact that appellant was doing and had been doing everything in its power to furnish the full amount demanded and desired, and because appellant was unable to furnish its consumers all the gas they desired, it denied appellant the established rate for the gas which it did actually furnish, although the established rate itself was unremunerative and confiscatory.

L. The Commission's finding and order was contrary to the undisputable character of the evidence.

M. The order was made upon no petition, complaint or pleading filed by any person and upon no evidence given by any person.

N. The statutes of Oklahoma forbid the taking of more than 25% of the open flow volume of the gas wells, thus limiting the quantity which may be taken, and yet the Company, being so limited, is penalized because of its physical inability to furnish all [fols. 509-510] the gas demanded.

Appellant believes that the entire record in the above cause is necessary for the consideration and determination of the questions to be presented therein, and appellant therefore requests that the entire record be printed.

David A. Richardson, Attorney for Plaintiff in Error.

Service of the above and foregoing is acknowledged to have been made upon us, the attorneys of record for defendant-in-error, on this 7th day of July, 1925.

For the Attorney General, by J. Berry King, Asst. Atty. Genl. E. S. Ratliff, Attorney for the Corporation Commission of the State of Oklahoma, Attorneys for Appellee.

[fol. 5414] [File endorsement omitted]

Endorsed on cover: File No. 31,288. Oklahoma Supreme Court. Term No. 565. Oklahoma Natural Gas Company, plaintiff in error, vs. The State of Oklahoma. Filed June 26th, 1925. File No. 31,288.